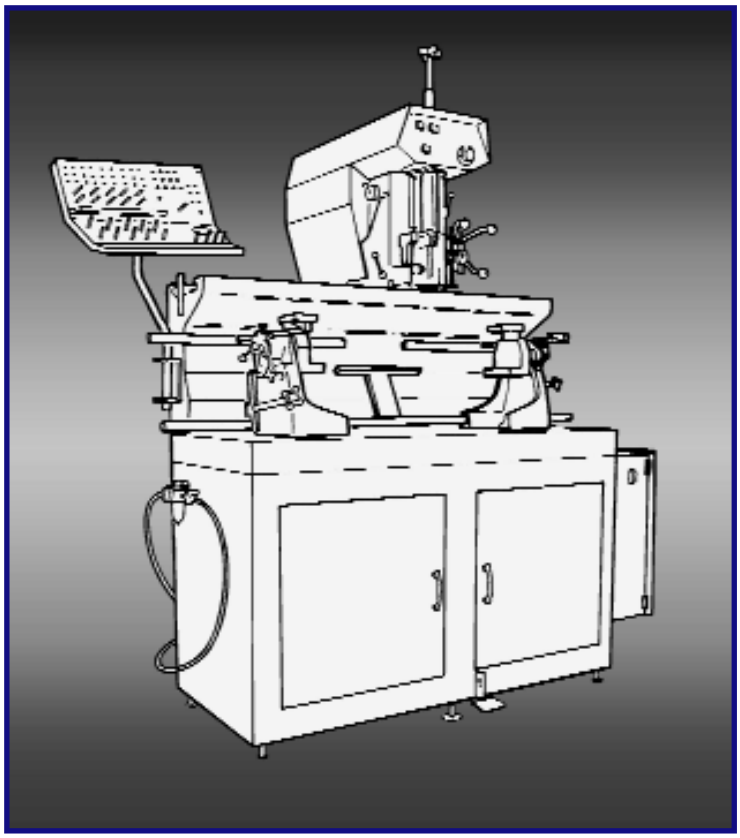
Installation, Setup and Operation

INSTRUCTIONS



for

SUNNEN® VALVE GUIDE & SEAT MACHINE

Model: VGS-20

READ THE FOLLOWING INSTRUCTIONS THOROUGHLY AND CAREFULLY BEFORE UNPACKING, INSPECTING, OR INSTALLING THE SUNNEN VALVE GUIDE & SEAT MACHINE.

"SUNNEN AND THE SUNNEN LOGO ARE REGISTERED TRADEMARKS OF SUNNEN PRODUCTS COMPANY."

SUNNEN® PRODUCTS COMPANY • 7910 MANCHESTER AVENUE • ST. LOUIS, MO 63143, U.S.A. • PHONE: 314-781-2100

GENERAL INFORMATION

The Sunnen® equipment has been designed and engineered for a wide variety of parts within the capacity and limitation of the equipment. With proper care and maintenance this equipment will give years of service.

READ THE FOLLOWING INSTRUCTIONS CAREFULLY AND THOROUGHLY BEFORE UNPACKING, INSPECTING, OR INSTALLING THIS EQUIPMENT.

IMPORTANT: Read any supplemental instructions BEFORE installing this equipment. These supplemental instructions give you important information to assist you with the planning and installation of your Sunnen equipment.

Sunnen Technical Service Department is available to provide telephone assistance for installation, programming, & troubleshooting of your Sunnen equipment. All support is available during normal business hours, 8:00 AM to 4:30 PM Central Time.

Review all literature provided with your Sunnen equipment. This literature provides valuable information for proper installation, operation, and maintenance of your equipment. Troubleshooting information can also be found within the Instructions. If you cannot find what you need, call for technical support.

Where applicable, programming information for your Sunnen equipment is also included. Most answers can be found in the literature packaged with your equipment.

Help us help you. When ordering parts, requesting information, or technical assistance about your equipment, please have the following information available:

- Have ALL MANUALS on hand. The Customer Services Representative or Technician will refer to it.
- Have Model Number and Serial Number printed on your equipment Specification Nameplate.
- Where Applicable: Have Drive model and all nameplate data. Motor type, brand, and all nameplate data.

For Troubleshooting, additional information may be required:

- Power distribution information (type - delta, wye, power factor correction; other major switching devices used, voltage fluctuations)
- Installation Wiring (separation of power & control wire; wire type/class used, distance between drive and motor, grounding).
- Use of any optional devices/equipment between the Drive & motor (output chokes, etc.).

For fast service on your orders call:

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Customers outside the USA, contact your local authorized Sunnen Distributor.
Additional information available at: http://www.sunnen.com or e-mail: sunnen@sunnen.com

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ESD PREVENTION REVIEW

Let's review the basics of a sound static control system and its effective implementation. First, in the three step plan:

1. Always ground yourself when handling sensitive components or assemblies.
2. Always use a conductive or shielded container during storage or transportation. These materials create a Faraday cage which will isolate the contents from static charges.
3. Open ESD safe containers only at a static safe work station.

At the static safe work station, follow these procedures before beginning any work:

A. Put on your wrist strap or foot grounding devices.

B. Check all grounding cords to make sure they are properly connected to ground, ensuring the effective dissipation of static charges.

C. Make sure that your work surface is clean and clear of unnecessary materials, particularly common plastics.

D. Anti-static bubble wrap has been included for use at the machine when an ESD safe workstation is not available.

You are now properly grounded and ready to begin work. Following these few simple rules and using a little common sense will go a long way toward helping you and your company in the battle against the hazards of static electricity. When you are working with ESD sensitive devices, make sure you:

GROUND

ISOLATE

NEUTRALIZE

SUNNEN® LIMITED PRODUCT WARRANTY

Sunnen® Products Company and its subsidiaries (SPC) warrant that all new SPC honing machines, gaging equipment, tooling, and related equipment will be free of defects in material and/or workmanship for a period of one year from the date of original shipment from SPC.

Upon prompt notification of a defect during the one-year period, SPC will repair, replace, or refund the purchase price, with respect to parts that prove to be defective (as defined above). Any equipment or tooling which is found to be defective from improper use will be returned at the customer's cost or repaired (if possible) at customer's request. Customer shall be charged current rates for all such repair.

Prior to returning any SPC product, an authorization (RMA#) and shipping instructions must be obtained from the Customer Service Department or items sent to SPC will be returned to the customer.

Warranty Limitations and Exclusions This Warranty does not apply to the following:

- Normal maintenance items subject to wear and tear: (belts, fuses, filters, etc).
- Damages resulting from but not limited to:
  - › Shipment to the customer (for items delivered to customer or customer's agent F.O.B., Shipping Point)
  - › Incorrect installation including improper lifting, dropping and/or placement
  - › Incorrect electric power (beyond +/- 10% of rated voltage) including intermittent or random voltage spikes or drops
  - › Incorrect air supply volume and/or pressure and/or contaminated air supply
  - › Electromagnetic or radio frequency interference from surrounding equipment (EMI, RFI)
  - › Storm, lightning, flood or fire damage
  - › Failure to perform regular maintenance as outlined in SPC manuals
  - › Improper machine setup or operation causing a crash to occur
  - › Misapplication of the equipment
  - › Use of non-SPC machines, tooling, abrasive, fixturing, coolant, repair parts, or filtration
  - › Incorrect software installation and/or misuse
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  - › Customer modifications to SPC software

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Shipping Damages

Except in the case of F.O.B., Buyer's destination shipments, SPC will not be liable for any settlement claims for obvious and/or concealed shipping damages. The customer bears the responsibility to unpack all shipments immediately and inspect for damage. When obvious and/or concealed damage is found, the customer must immediately notify the carrier's agent to make an inspection and file a claim. The customer should retain the shipping container and packing material.

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Any alteration or reverse engineering of the software is expressly forbidden and is in violation of this agreement.

SPC reserves the right to update the software covered by this agreement at any time without prior notice and any such updates are covered by this agreement.

SAFETY INSTRUCTIONS

READ FIRST

This machine, like any machine tool, may be dangerous if used improperly. Please read all warnings and instructions before attempting to use this machine.

DO NOT remove or defeat any safety device.

Always disconnect power at main enclosure before servicing machine.

Always wear eye protection when operating this machine.

DO NOT attempt any repair or maintenance procedure beyond those described in this book. Contact your Sunnen® Service Representative for repairs not covered in this book. Much of the safety of the reconditioning operation is dependent on how the workpiece is fixtured. Several standard fixturing components are available, depending on your application.

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GENERAL INFORMATION & SPECIFICATIONS

Sunnen Valve Guide and Seat Machines
Model VGS-20

Standard Equipment:	Universal, 360º tilting fixture Tool storage rack & built-in cabinet
Floor Area – Width: Depth: Height:	 1450 mm (57 in.) 915 mm (36 in.) 1982 mm (78 in.)
Seat Pocket Diameters:	30,1–57,1 mm (1.5–2.25 in.) Optional: 23,8–76,2 mm (15/16–3 in.)
Valve Seat Diameters - Single-Blade: Three-Blade:	 17–63,5 mm (.669–2.5 in.) 25,4–63,5 mm (1–2.5 in.)
Spindle Motor:	3/4 HP, infinitely variable speed, reversible
Spindle Speed:	20-420 RPM
Shipping Weight:	580 kg (1272 lbs)
Electrical Requirements:	220/230V, 1 Ph, 50/60 Hz 208V, 1 Ph, 60 Hz 12.2 amp maximum current
Pneumatic Requirements:	120L/min @6,8 Bars 4 CFM @100 psi
Color:	Pearl Gray, Pewter Gray & Burgundy Trim

INTRODUCTION

This Instruction Manual provides information required to install, operate, and maintain the Sunnen VGS-20 Valve Guide & Seat Machine.

When ordering parts for, or requesting information about your unit, include the serial and model numbers stamped on the Nameplate located on right side of your machine base.

READ THE FOLLOWING INSTRUCTIONS CAREFULLY AND THOROUGHLY BEFORE UNPACKING, INSPECTING, INSTALLING OR OPERATING YOUR MACHINE.

SECTION 1
INSTALLATION

PURPOSE

Consult this section when unpacking, inspecting, and installing Sunnen VGS-20 Valve Guide & Seat Machine. Hereafter, referred to as the Machine (see Figure 1-1).

SUGGESTED TOOLS & MATERIALS

The following tools and materials are required for unpacking and installing of your Machine:

Knife	Hex Wrenches
Hammer	Open End Wrenches
Crow Bar	Cleaning Solvent
Tin Snips	

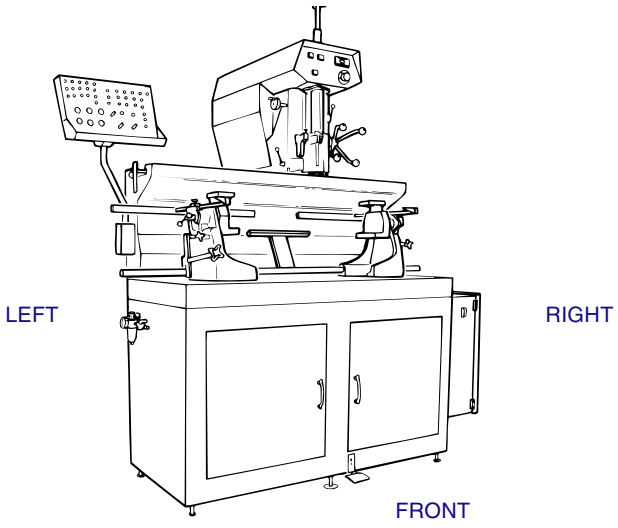


FIGURE 1-1, VGS-20 Valve Guide & Seat Machine

UNPACKING, INSPECTING & INSTALLING

Read the following instructions carefully and thoroughly before unpacking, inspecting and installing Machine. All references to right and left in these instructions, unless otherwise noted, are as seen by operator as one looks at Machine or assembly being described.

NOTE: When ordering parts for, or requesting information about your Machine, include Model and Serial Numbers stamped in Nameplate located on left side of Machine Base.

1. Remove top and sides of shipping carton.

2. Remove any loose components packaged with Machine.

Remove box of accessories packed inside Machine Cabinet. Locate and remove the five (5) leveling screws, lock nuts, and leveling pads so they can be used to install the Machine. Refer to step 6.

3. Inspect Machine and components for dents, scratches, or damage resulting from improper handling by carrier. *If damage is evident, immediately file a claim with carrier.*

4. Remove four (4) Bolts securing Machine to skid, by reaching under skid.

CAUTION

THIS MACHINE IS TOP-HEAVY. Use care when lifting and moving Machine. Approximate shipping Weight of Machine is 1272 lbs. (580 kg).

5. Lift Machine using a fork lift. Move fork lift to front of Machine and separate forks so they are visually centered under Doors on Machine Cabinet Base. Insert forks under front-center of Machine, using care not to damage Foot Pedal Valve or Air Lines. Tilt forks slightly upward so Machine will lean toward fork lift and lift Machine.

6. While Machine is on fork lift, install five (5) Leveling Screws and Jam Nuts in holes provided in bottom of Machine Base.

Two (2) Screws installed in rear-corners and one (1) Screw installed in front-center of Machine Base will serve as Leveling Screws; while two (2) Screws installed in front-corners of Machine Base will serve only as Support Screws.

7. Move Machine to desired location and place a Leveling Pad under all five (5) Screws.

WARNING

Use safety glasses or goggles when cutting bands.

8. Cut, remove and discard shipping bands. DO NOT remove bands holding Head Support Assembly at this time.

9. Attach Foot Pedal to front of Machine Base (see Figure 1-2) by aligning Mounting Bracket with hole in Base and installing Mounting Screw. Adjust Pedal height and tighten Screw.

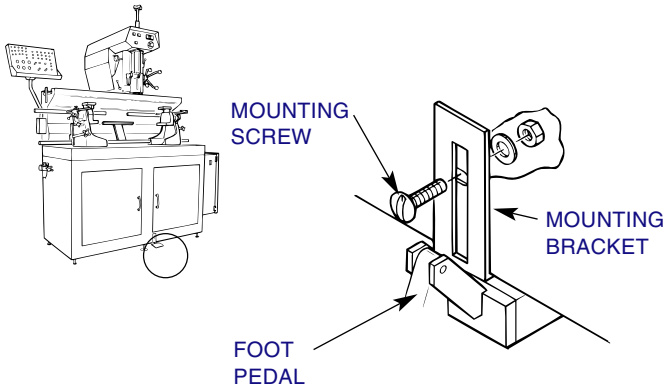


FIGURE 1-2, Install Foot Pedal

10. Route and connect Air Lines as follows (see Figure 1-3):

Route Air Line “A”, which is attached to right-rear of Foot Pedal Valve, under right-rear of Machine Base and up right side of Machine. Connect Air Line “A” to Connector “A1” on Filter Regulator.

Route taped pair of Air Lines “B” & “C”, which are attached to left side of Foot Pedal Valve, under left-rear of Machine Base and up rear of Machine. Reach up and under Back Cover of the Power Head Shroud and connect Air Lines “B” & “C” to two (2) Connectors “B1” and “C1” in Power Head.

NOTE: Air Line “C” is marked in Red and should attach to Connector “C1”, which is also marked in Red.

11. Left side of Machine: Remove Hex Head Plug from T-Connector in Air Line and install a Quick-Connect Fitting (see Figure 1-4). This fitting is for use of optional equipment with your Machine.

12. Install Shut-Off Valve in intake side of Air Filter Unit and CONNECT Factory Air Supply Line to Shut-Off Valve.

NOTE: Quick-Connect Fitting, Shut-Off Valve and Factory Air Supply Line are not supplied. Factory air supply requires a minimum of 100 psi (690 kPa) of clean, dry compressed air. Filter Regulator is preset at factory to 100 psi. DO NOT readjust.

13. Level Machine Base as follows (see Figure 1-5):

Obtain a Precision Machinist Level and lay lengthwise (left to right) on top Rail of Table Riser.

Screw Support Screws up into Machine Base to ensure they will not interfere with the leveling of Machine.

Loosen Jam Nuts on three (3) Leveling Screws in rear-corners and front-center of Machine Base.

Adjust Leveling Screws until Machine is leveled left to right and reasonably level front to back.

Tighten Jam Nuts on REAR Leveling Screws ONLY.

Remove Level from Table Riser.

CAUTION

Only loosen two (2) Shipping Bolts (marked in Red) on each side of Power Head which require a 1/2” box wrench. DO NOT loosen or remove the adjacent Clamp/Guide Bolts which require a 9/16” box wrench.

14. Remove four (4) Shipping Bolts securing Power Head as follows (see Figure 1-6):

Remove End Stops on left and right ends of Table Riser by removing a single Hex Head Capscrew and Washer from each Stop.

Remove wooden blocks from between Rails.

Using a long, straight 1/2” Box Wrench, reach under Clamp Plate and loosen two (2) Shipping Bolts (marked in Red), located on each side of the Power Head. DO NOT attempt to remove Bolts at this time.

Wipe top Rails with a clean, dry cloth to remove protective shipping oil.

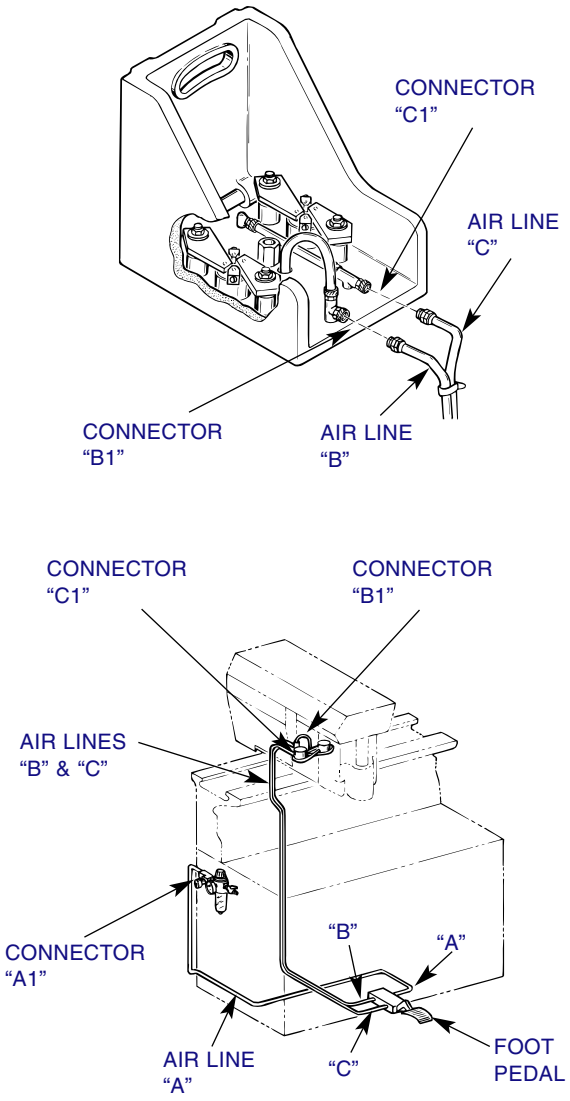


FIGURE 1-3, Connect Air Lines

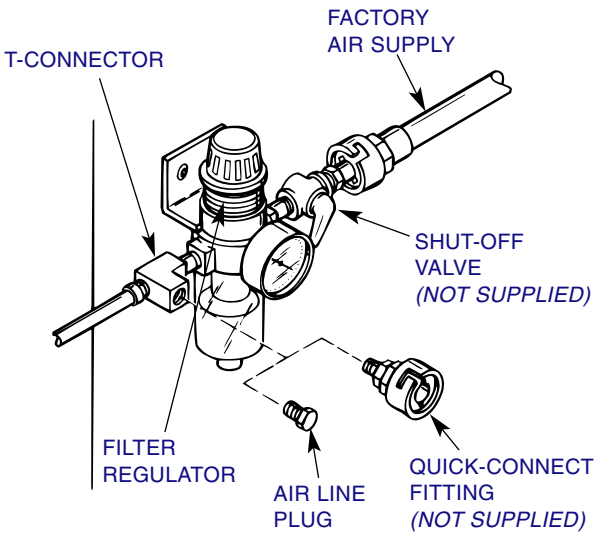


FIGURE 1-4, Air Regulator

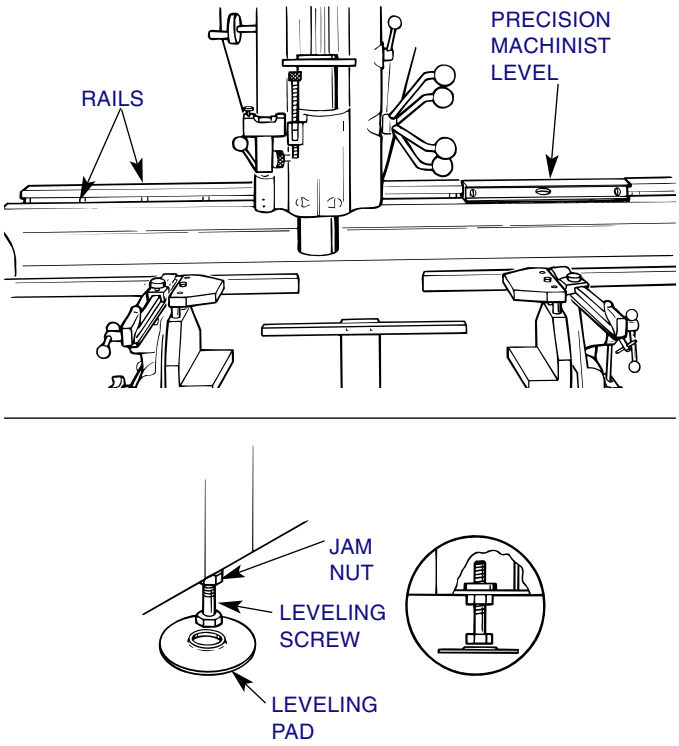


FIGURE 1-5, Level Machine Base

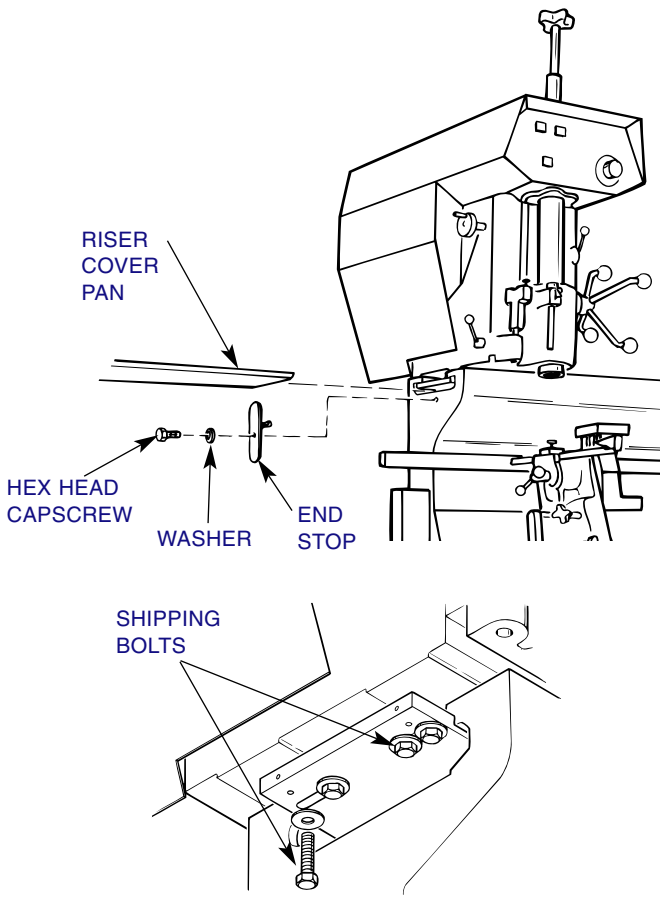


FIGURE 1-6, Remove Shipping Bolts

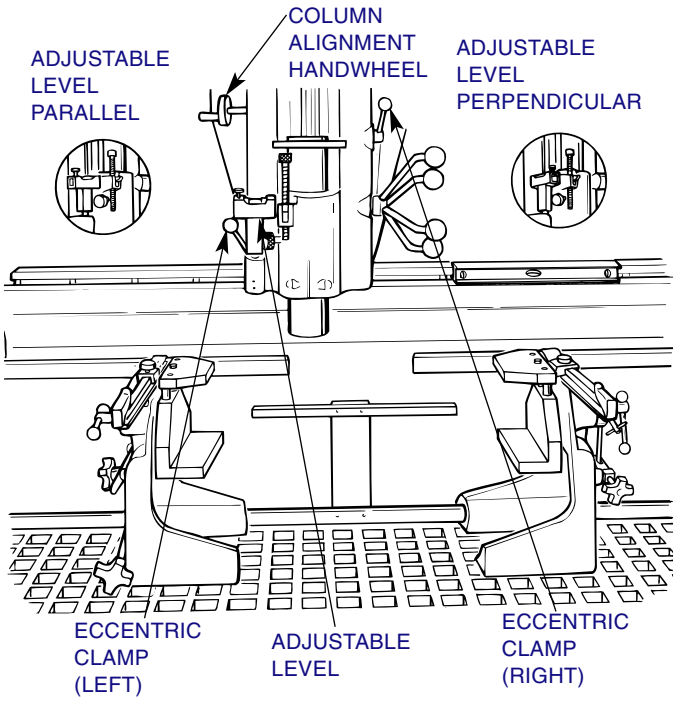


FIGURE 1-7, Level Power Head

CAUTION

DO NOT attempt to move Power Head unless Air Supply is connected, Shut-Off Valve is turned on, and Foot Pedal is depressed, allowing Head to float on Rails.

Depress Foot Pedal and float Power Head far enough to one side so Brass Shims can be removed.

Wipe area of Rails clean where Shims were located.

WARNING

Use care when floating power head near ends of rails when stops are not in place; head could slide off end of machine, causing personal injury and damage to machine.

Carefully float Head to one end of Machine. Allow Head to overhang edge of Machine just enough so two (2) of the (Red Headed) Shipping Bolts can be removed.

Float Head to opposite end of Machine and remove two (2) remaining (Red Headed) Shipping Bolts.

Float Head to center of Machine.

Slide long sheet metal Riser Cover Pan (packaged with Machine) between top Rails.

Reinstall End Stops, Washers and Hex Head Capscrews. Securely tighten Capscrews.

15. Level Power Head as follows (see Figure 1-7):

Place Adjustable Level (provided) on Leveling Pin located on left-front of Spindle Guide Housing.

Loosen Adjusting Screws in top of Level and rotate Level so it is parallel to Machine Table (left to right).

NOTE: Rotate Level 180° to check that Level is properly adjusted. If Level does not read same in both directions, readjust according to Section 4.

Pull down on Eccentric Clamps (Release Position).

Use Column Alignment Handwheel to adjust (Level) Power Head from left to right.

First push up on (Lock Position) right Upper Eccentric Clamp; then lock left Lower Eccentric Clamp.

Rotate Level 90º so it is perpendicular to Machine Table (front to back).

Readjust single front-center Leveling Screw of Machine until bubble is centered in Level, indicating that Head is leveled front to back. Tighten Jam Nut on front-center Leveling Screw.

Carefully screw out Support Screws on two front-corners of Machine, until they just touch floor (Leveling Pads). These two Screws are used only as support for front-corners of Machine. DO NOT use these screws for leveling.

16. Recheck Machine Base and Power Head to ensure Machine is level and does not rock.

17. Install Spindle Drawbar as follows (see Figure 1-8):

Turn Feed Lever Wheel clockwise (toward rear of Machine) until Wheel stops turning. This is to fully retract Spindle up into Spindle Guide Housing.

Insert Spindle Drawbar up through bottom of Spindle.

Push up and rotate Drawbar so groove in Drawbar lines up with Pin in top of Spindle.

Continue to push up on Drawbar until it is protruding approximately 3/4 in. (19 mm) above top of Spindle; then screw Drawbar Knob onto top of Drawbar.

18. If optional Air Hammer (Valve Guide Installation Kit) is to be installed, attach to Quick-Connect Fitting (installed in step 11) on left side of Machine (see Figure 1-9).

WARNING

Use safety glasses or goggles when cutting bands.

19. Cut Shipping Bands securing Head Support Assembly to Table. Remove bands and wooden shipping blocks.

20. Remove any packaging material, which may remain, from Machine.

21. After unpacking and installing Machine, clean and lubricate (refer to Section 4).

22. A Tool Rack is located on left end of Table Riser. Large Tools and supplies may be stored in Machine Cabinet Base.

23. If optional Seat Depth Indicator is to be installed, attach to right side of Power Head according to instructions packaged with Indicator (see Figure 1-10).

(CE) INSTALL TOP GUARD

To install Top Guard, proceed as follows (see Figure 1-11):

1. Turn OFF all electrical power to the machine at Master On/Off Switch, located on the right side of the Electrical Control Enclosure.

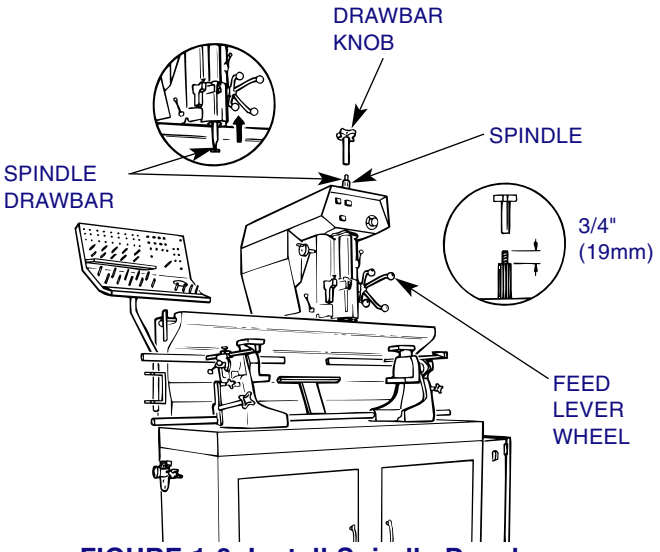


FIGURE 1-8, Install Spindle Drawbar

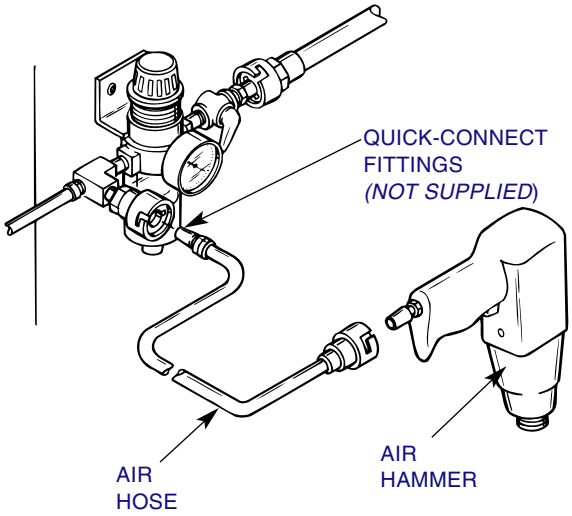


FIGURE 1-9, Optional Air Hammer

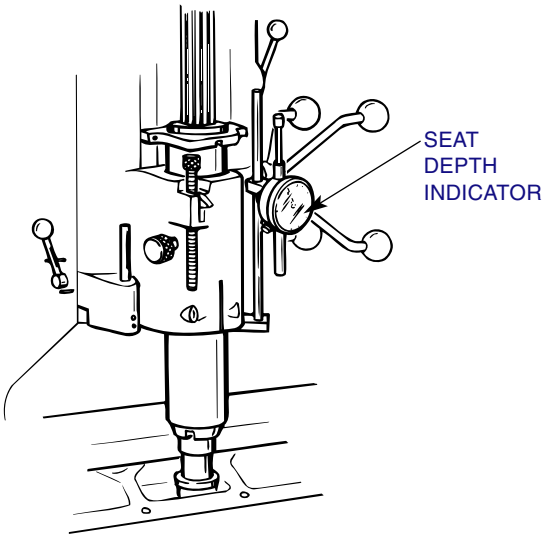


FIGURE 1-10, Seat Depth Indicator

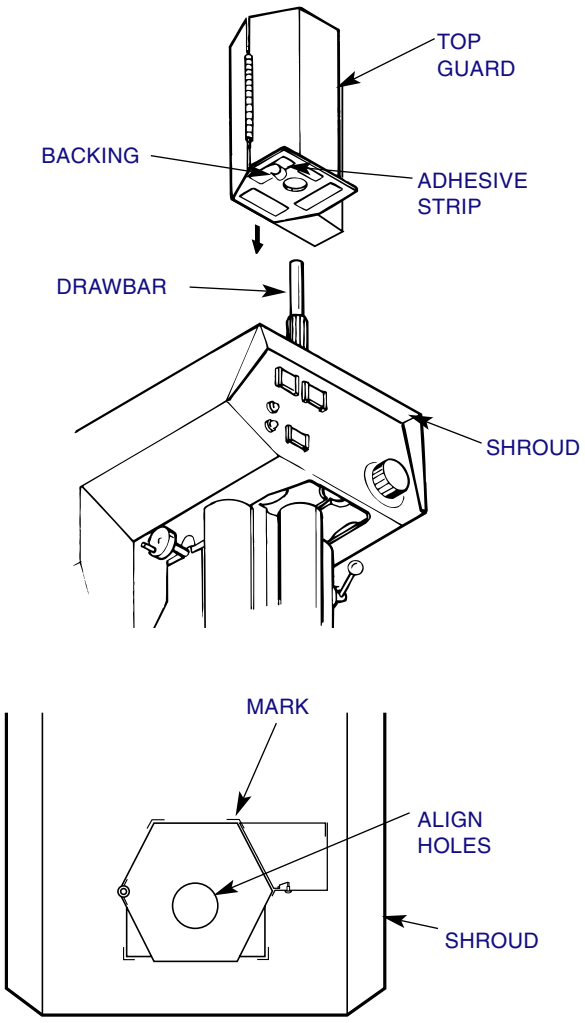


FIGURE 1-11, Top Guard

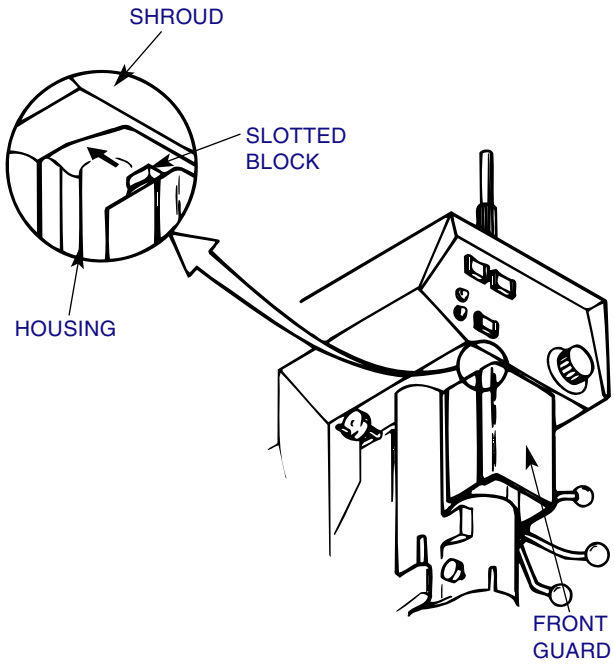


FIGURE 1-12, Front Guard

2. Loosen Set Screw in Drawbar Knob and unscrew Knob from top of Drawbar.

3. Clean the top of the Power Head Shroud, to ensure the surface is free of solvents, grease, and dirt. Wipe top of shroud with warm water; then wipe with a solution of half water and half rubbing alcohol; and finally wipe with a clean paper towel.

4. Slide new Top Guard over Drawbar and align hole in guard with hole in top of shroud. Ensure front edge of guard is parallel to front edge of shroud. Then mark location of guard on top of shroud with a pencil.

5. Remove guard and peel protective backing from Adhesive Strips on the bottom of guard.

CAUTION

Ensure guard is properly aligned with marks before Adhesive Strips contact top of shroud.

6. Carefully slide guard down over drawbar and visually align guard with marks on top of shroud. When guard properly aligns with marks, press down firmly on base of guard. Bond will reach full strength in 72 hours.

7. Replace Drawbar Knob and tighten Set Screw.

8. Close top guard door and lock, using 5/32” hex wrench.

NOTE: This Guard should be closed and locked during Machine operation.

(CE) INSTALL FRONT GUARD

To install Front Guard, proceed as follows (see Figure 1-12):

1. Raise Spindle about halfway, using Feed Lever Wheel, and lock in place.

2. Slide Slotted Block on left side of Front Guard over left edge of cutout in bottom of Power Head Shroud.

3. Slide guard back until block is flush against spindle housing and slot is bottomed out against edge of cutout. Then tighten Set Screw in block.

NOTE: Plastic Door should be flush with front of the Operator Control panel when closed. Readjust guard if required.

4. Unlock spindle and turn ON power to machine.

NOTE: This Guard should be closed and locked during Machine operation.

ELECTRICAL CONNECTIONS

All wiring is to be performed by a competent, Licensed Electrician in accordance with all local, state, and federal codes and regulations; along with any special information provided on machine nameplate or electrical specification plate.

CAUTION

Doors are equipped with lockable Safety Door Latches. Doors should be closed and latched during operation to prevent accidental interruption of operation from doors being opened. Doors Latches should be Locked-Out and Tagged during servicing to prevent machine from being powered up.

1. If applicable: Loosen Safety Latches on door(s) to enclosure, using a screwdriver. Or, on CE models, unlock doors to Electrical Control Enclosure using key supplied with machine. Door(s) to enclosure is equipped with Key-Lock Safety Latches.

WARNING

Residual Voltage exists for 2-3 minutes after Master ON/OFF Switch is turned OFF. Before working inside Enclosure, wait for all fans to stop running to allow drives to discharge.

2. Turn Master ON/OFF Switch to OFF position and open Doors (see Figure 1-13). (Doors WILL NOT open unless Master ON/OFF Switch is in OFF position.)

WARNING

You must use hole provided. Drilling any new holes in electrical enclosure may void machine warranty.

3. If not provided: Remove hole plug from entrance hole in enclosure and install an approved oil tight fitting.

4. Insert Electrical Supply Cord through Oil Tight Fitting and route to Electrical Disconnect Block.

5. Strip 254 mm (10 in.) off cable's outer jacket.

6. Strip 6 mm (1/4 in.) of insulation off each wire.

7. Connect Green Wire (GRN) to PE Terminal on Electrical Disconnect Switch (Earth Ground).

8. Connect White and Black Wires to Electrical Disconnect Block as noted on block.

9. Route and secure Cord inside of Enclosure.

10. Tighten Oil Tight Fitting.

11. Close and secure/lock Door(s) to Enclosure.

12. Route and connect Electrical Supply Cord to power source. (PLUG Machine's Electrical Supply Cord into a properly polarized grounding-type wall receptacle.)

13. Turn ON Master ON/OFF Switch.

OPERATIONAL CHECK

Read Sections 2 and 3 carefully and thoroughly before performing Operational Check.

1. Operate Machine and check that motor and spindle are operating smoothly.

2. Operate Machine and check rotation of Spindle Shaft. With Blue Reverse Button OUT: Shaft should rotate clockwise (left to right) as viewed from top of

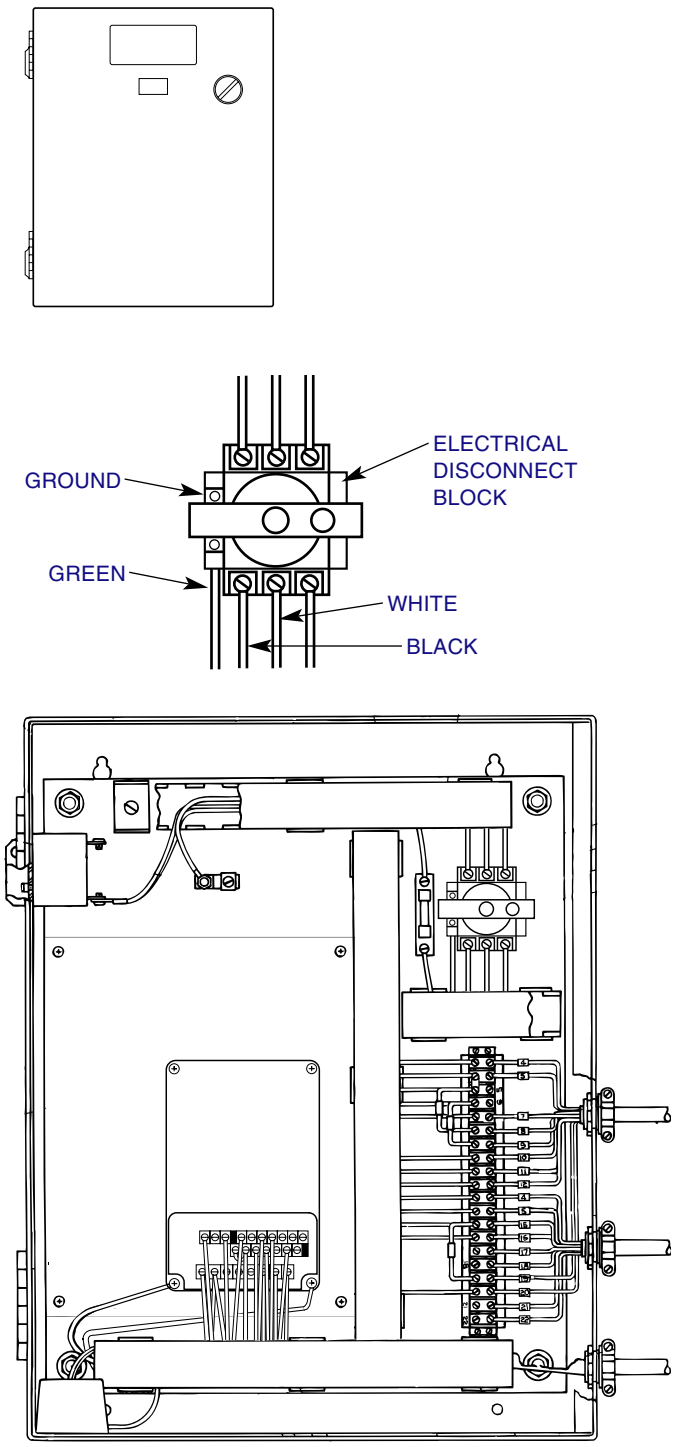


FIGURE 1-13, Electrical Connection

Shaft. If rotation is incorrect, check that (1) Reverse Button is in Out Position, (2) wall receptacle is properly wired, and (3) white and black wires of Electrical Supply Cord are connected correctly to panel inside of Electrical Control Enclosure.

3. Turn ON factory Air Supply, depress Foot Pedal, and check that Power Head floats easily and smoothly on Rails. If Head does not operate smoothly, clean Rails, check air pressure setting, and check air line connections (refer to Section 1 and Section 4).

SECTION 2
PREPARING FOR OPERATION

GENERAL

Consult this section when preparing Machine for operation.

LOCATION OF MAJOR COMPONENTS

For location of major components on Machine see Figure 2-1.

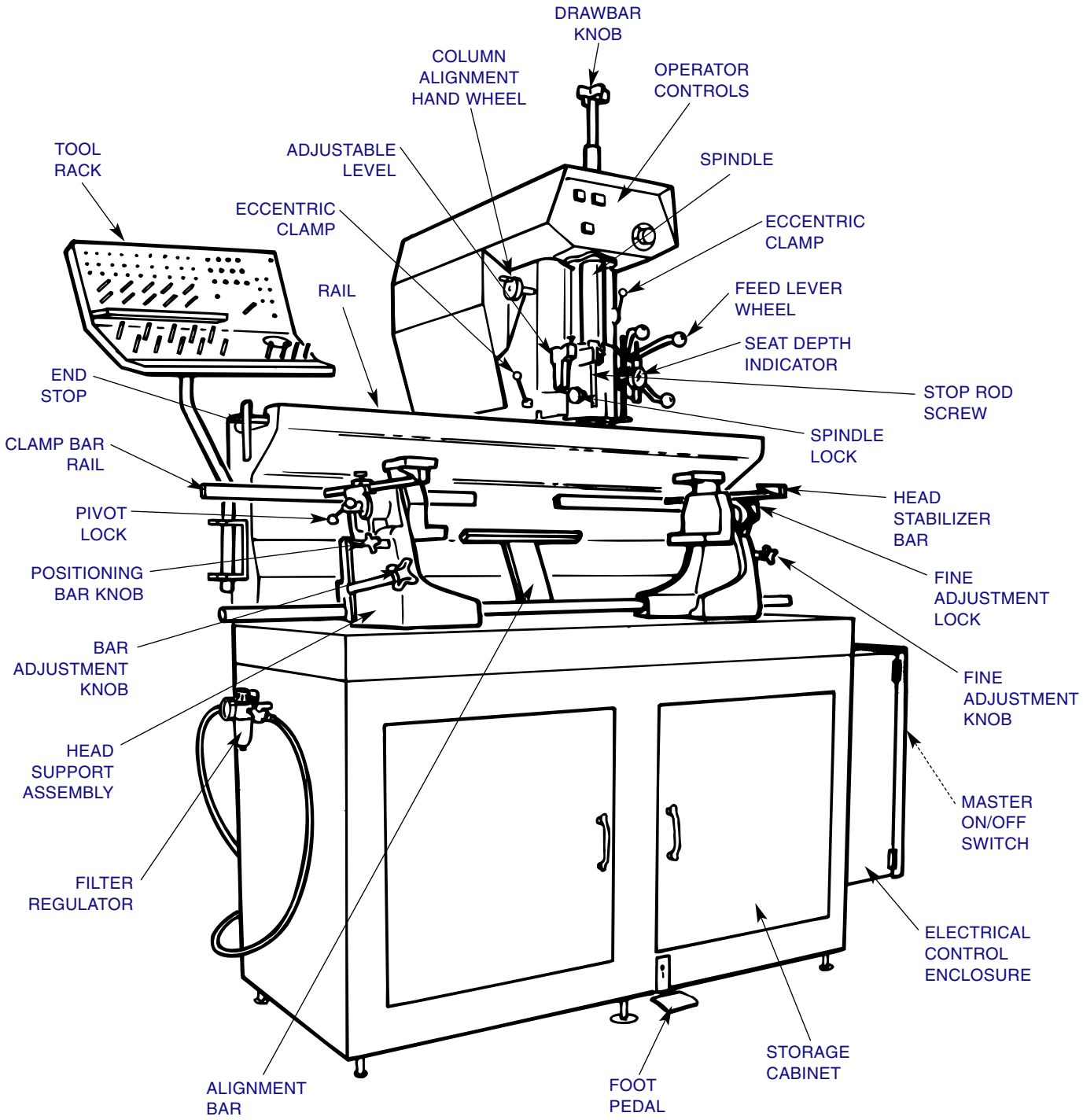


FIGURE 2-1, Valve Guide & Seat Machine

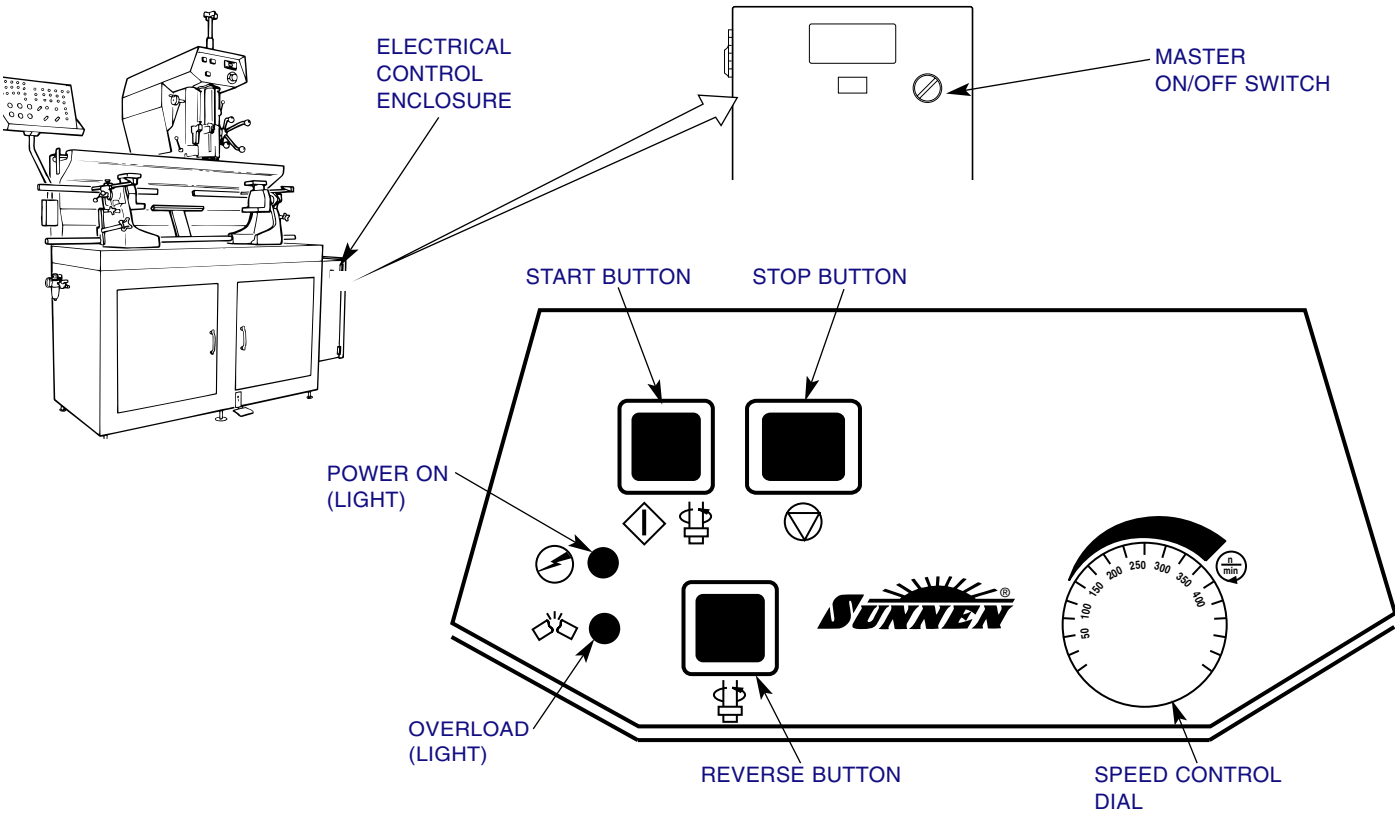


FIGURE 2-2, Operator Controls

TABLE 2-1, Operator Controls

SYMBOL	DESCRIPTION	FUNCTION
	POWER ON LIGHT (Green)	Indicates when power is being supplied to Motor Controls
	OVERLOAD LIGHT (Red)	Indicates when Spindle Drive Motor has stopped due to an overload (Depress STOP Button to reset)
	START (Pushbutton, Green)	STARTS Spindle Drive Motor
	STOP (Pushbutton, Red	STOPS Spindle Drive Motor
	REVERSE (Pushbutton, Blue)	When latched IN - spindle will rotate counterclockwise (reverse) When OUT - spindle will rotate clockwise (forward)
n/min	SPEED CONTROL DIAL	(Potentiometer) Use to select approximate RPMs at which spindle rotates
	MASTER ON/OFF SWITCH	Controls ALL electrical power to Machine (Electrical Control Enclosure)

TABLE 2-2, Other Machine Control and Warning Symbols

SYMBOL	DESCRIPTION	FUNCTION
	Warning Label	Warns that an electrical hazard exists.
	Warning Label	Warns that power must be off with belt guard open to prevent injury, and that hand and finger hazards exist.
	Warning Label	Warns that safety glasses should be worn at all times when operating this machine.
	Warning Label	Warns that a hazard from objects falling off work table exists and that proper precautions should be taken.

LOCATION OF OPERATOR CONTROLS

For location and function of operator controls, refer to Figure 2-2 and Table 2-1.

DESCRIPTION OF SAFETY SYMBOLS

For a description of safety symbols used on this machine, refer to Table 2-2.

CYLINDER HEAD SETUP

1. Release Head Stabilizer Bars by pulling up on Latch Handles. Then slide Head Support Assembly out, toward front of Machine.

2. One at a time, adjust Head Stabilizer Bars as follows (see Figure 2-3):

Loosen Vertical Slide Lock Screw.

While holding down on Head Stabilizer Latch, slide Notched Bar to "0". Then raise Head Stabilizer Latch and allow it to reengage Notched Bar.

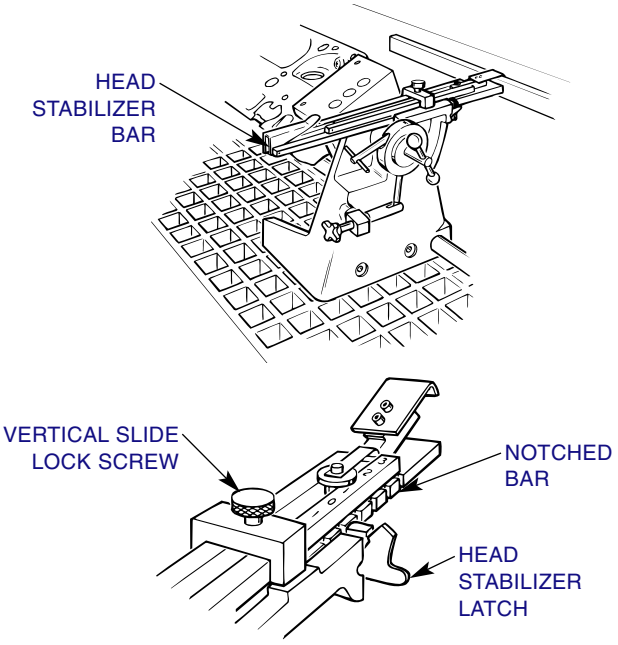


FIGURE 2-3, Adjust Head Stabilizer Bars

Tighten Vertical Slide Lock Screw.

Repeat for remaining Head Stabilizer Bar.

3. Loosen Pivot Lock in end of right Head Support Casting, rotate Swivel Clamp to Load Position, so Solid L-Shaped Holder is on the bottom, and tighten Pivot Lock (see Figure 2-4). Adjust left Swivel Clamp in same manner.

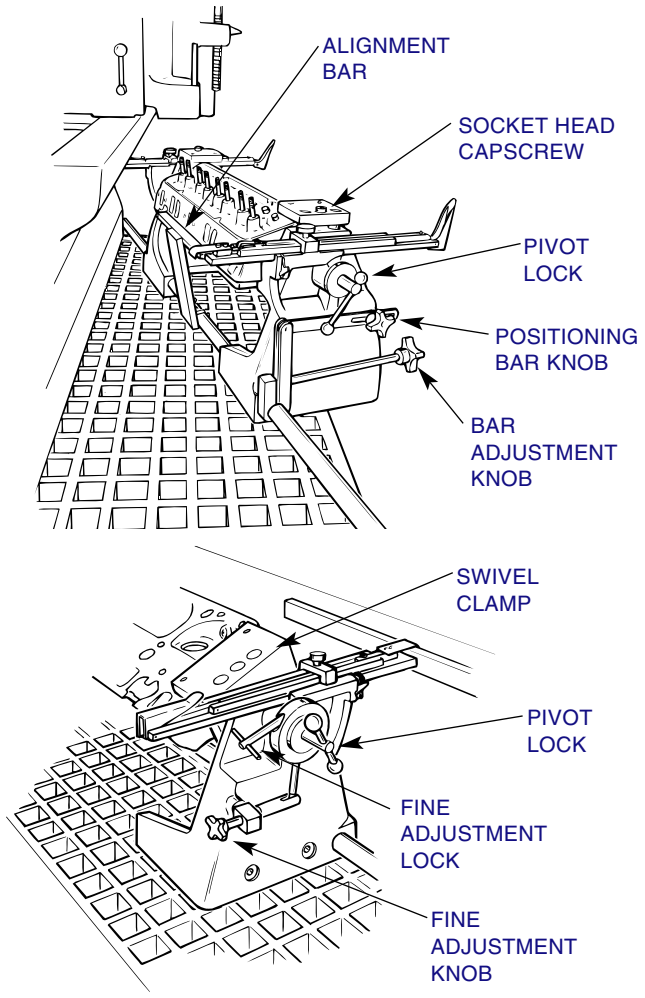


FIGURE 2-4, Cylinder Head Setup

4. Loosen Positioning Bar Knob, push Alignment Bar toward rear of Machine and lightly tighten Knob.

5. Spread Head Support Castings to proper width for Cylinder Head which is to be installed.

6. Loosen Socket Head Capscrews in top of Swivel Clamps.

7. Place Cylinder Head in Swivel Clamps with machined face down and machined edge toward rear of Machine. Tighten Socket Head Capscrew in left Swivel Clamp ONLY.

8. Loosen Pivot Lock in right Head Support Casting to allow right Swivel Clamp to align itself with left Swivel Clamp. Tighten Socket Head Capscrew; then tighten Pivot Lock.

9. Slide Head Support Assembly back until Head Stabilizer Bars contact Clamp Bar Rail. Clamp Head Stabilizer Bars to Rail by pushing back on Latch Handles (see Figure 2-5).

NOTE: Stabilizer Hooks should lock over top of Clamp Bar Rail as illustrated (refer to Figure 2-5).

10. Position Cylinder Head as follows (see Figure 2-6):

Loosen Positioning Bar Knob and push down on Bar Adjustment Clamp Knob until Alignment Bar is up against machined edge on rear of Cylinder Head. Tighten Positioning Bar Knob.

NOTE: If Alignment Bar is not touching Cylinder Head, loosen Bar Adjustment Knob and pull Alignment Bar up against machined edge of Cylinder Head. Tighten Bar Adjustment Knob.

Loosen Socket Head Capscrews in top of Swivel Clamps.

Slide Cylinder Head back against Alignment Bar so contact is made along entire length of Bar by Head. Check alignment of Valve Guides to ensure they are on approximate center line of Swivel Clamps. DO NOT allow Clamps to cover combustion chambers, as Clamps may interfere with tooling or reconditioning operation. Tighten Socket Head Capsrews in Swivel Clamps.

Loosen Positioning Bar Lock Knob and raise Bar Adjustment Clamp Knob to move Alignment Bar toward rear of Machine so it is clear of Cylinder Head. Lightly tighten Knob.

CYLINDER HEAD ALIGNMENT

To align Cylinder Heads which have Canted Valve Guides, refer to Cylinder Head & Power Head Alignment (Canted). To align Heads with Standard Valve Guides, proceed as follows:

1. Install Cylinder Head.

2. Loosen Pivot Locks and rotate Cylinder Head 180º, so combustion chambers are in up position and Valve Guides are approximately vertical (see Figure 2-7).

3. Tighten Fine Adjustment Lock. DO NOT tighten Pivot Locks.

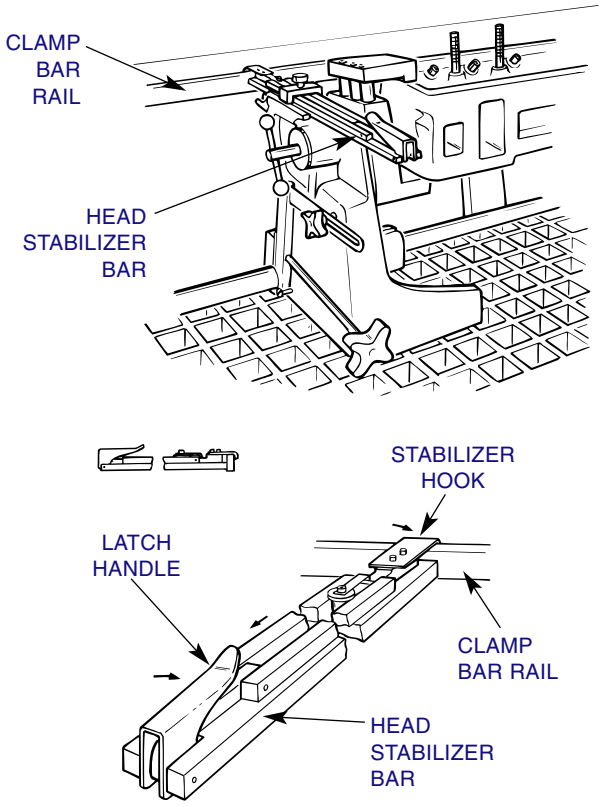


FIGURE 2-5, Head Stabilizer Bars

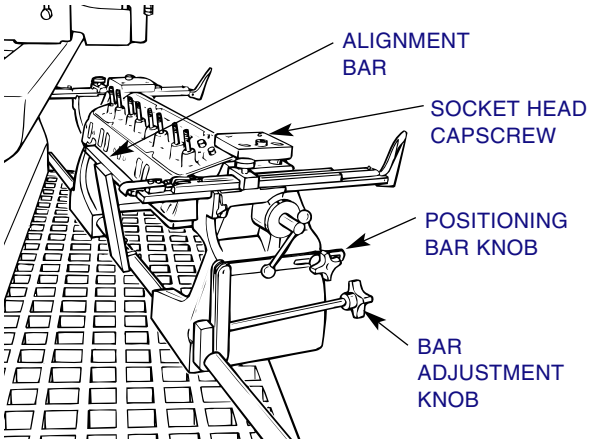


FIGURE 2-6, Position Cylinder Head

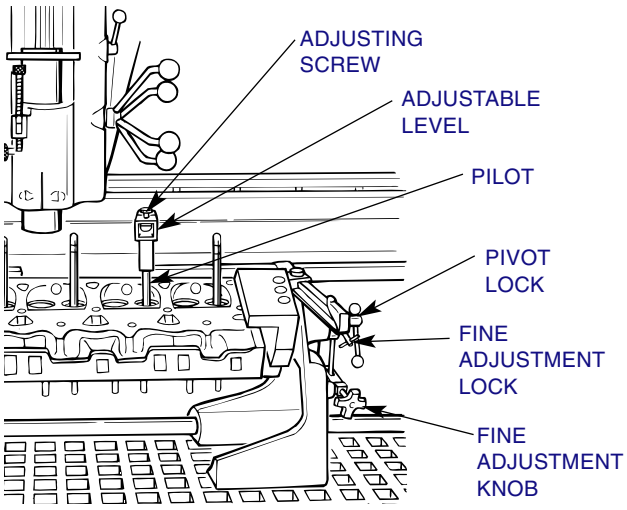


FIGURE 2-7, Align Cylinder Head

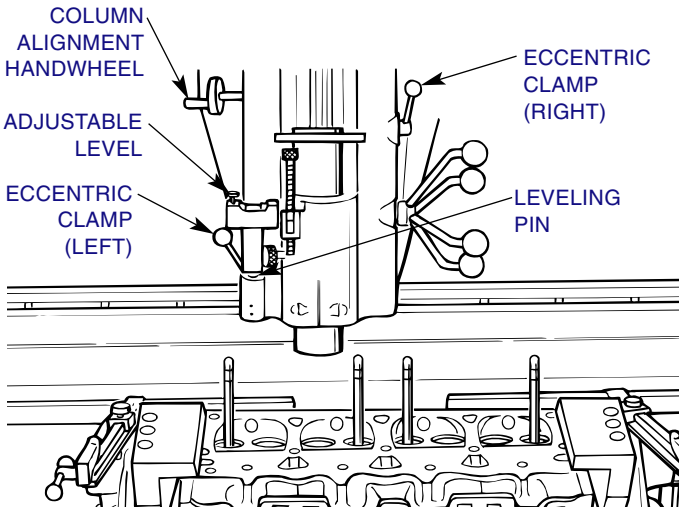


FIGURE 2-8, Align Power Head

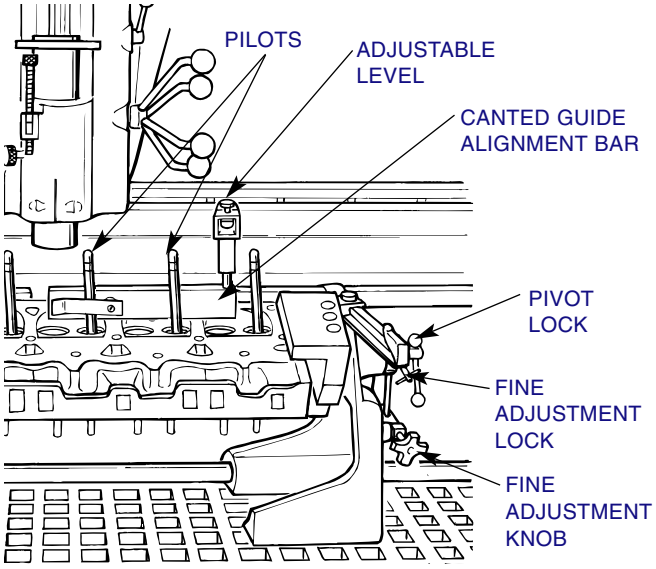


FIGURE 2-9, Align Cylinder Head (Canted)

4. Clean valve guides with brush to remove foreign matter.

5. To determine Pilot size, measure valve guides using Sunnen P-300 Valve Guide Gage.

6. Install largest size Pilot that will fit into valve guide. Pilot should not be more than .001 in. (0,03 mm) smaller than valve guide.

7. Place Adjustable Level on Pilot so Level is positioned front to back (refer to Figure 2-7).

8. Loosen Adjusting Screw on Level.

NOTE: Rotate Level 180° to check that Level is properly adjusted. If Level does not read same, adjust Level according to Section 4.

9. To center bubble in Level, turn Fine Adjustment Knob CLOCKWISE. (Knob is located on right end of Head Support Assembly.)

NOTE: It may be necessary to turn Knob counterclockwise first and then turn Knob clockwise. This will take the slack out of the threads so Knob will be solid when tightening left Pivot Lock.

10. First tighten left Pivot Lock, then tighten right Pivot Lock.

11. Recheck alignment and readjust as required.

12. Place Adjustable Level on one of the Pilots and rotate it so it is parallel with Head (left to right).

13. Turn Adjusting Screw to center bubble in Level.

14. Remove Adjustable Level from Pilot and place on Leveling Pin located on left-front of Spindle Guide Housing (see Figure 2-8).

15. Rotate Level so it is parallel to Cylinder Head (left to right, as it was in step 12).

16. Pull down on Eccentric Clamps (Release Position).

17. Turn Column Alignment Handwheel to center bubble in Level.

18. First push up on (Lock Position) right Upper Eccentric Clamp, then lock left Lower Eccentric Clamp.

CYLINDER HEAD ALIGNMENT (CANTED)

To align Cylinder Heads which have Canted Valve Guides, proceed as follows (see Figure 2-9):

1. Install Cylinder Head.

2. Loosen Pivot Locks and rotate Cylinder Head 180°, so combustion chambers are in up position and Valve Guides are approximately vertical.

3. Tighten Fine Adjustment Lock. DO NOT tighten Pivot Locks.

4. Clean valve guides with brush to remove foreign matter.

5. To determine Pilot size, measure valve guides using Sunnen P-300 Valve Guide Gage.

6. Install two (2) Pilots in exhaust or intake valve guides to be machined. approximately 6 to 8 in. (150 to 200 mm) apart. Install largest size Pilots which will fit into valve guides. Pilots should not be more than .001 in. (0,03 mm) smaller than valve guides.

7. Install Canted Guide Alignment Bar on high side of Pilots. With Locating Pin pointing up, clamp Retaining Spring around left Pilot and allow Bar to rest against right Pilot.

8. Slide Bar down Pilots so it is resting on Cylinder Head.

9. Place Adjustable Level on Bar Locating Pin. Rotate Level so it is positioned front to back (refer to Figure 2-9).

10. Loosen Adjusting Screw on Level.

11. To center bubble in Level, turn Fine Adjustment Knob CLOCKWISE. (Knob is located on right end of Head Support Assembly.)

NOTE: It may be necessary to turn Knob counterclockwise first and then turn Knob clockwise.

12. First tighten left Pivot Lock; then tighten right Pivot Lock.

13. Recheck Level and readjust as required.

14. Remove Level from Canted Guide Alignment Bar and remove Bar.

15. Place Adjustable Level on one of the Pilots (see Figure 2-10) and rotate it so it is parallel with Head (left to right).

16. Turn Adjusting Screw to center bubble in Level.

CAUTION

DO NOT move Adjusting Screw after it is set. Power Head must be set at same angle as Canted Valve Guides.

17. Remove Adjustable Level from Pilot and place on Leveling Pin located on left-front of Spindle Guide Housing (see Figure 2-11).

18. Rotate Level so it is parallel to Cylinder Head (left to right, as it was in step 15).

19. Pull down on Eccentric Clamps (Release Position).

20. Turn Column Alignment Handwheel until bubble is again centered in Level.

21. Push up on (Lock Position) right Upper Eccentric Clamp first, then lock left Lower Eccentric Clamp.

NOTE: Power Head is now aligned with Canted Valve Guides.

SEAT POCKET CUTTER

To set Cutting Head on Sunnen Seat Pocket Cutters proceed as follows:

NOTE: Setting Fixture is included in Sunnen VGS Seat Pocket Cutter Kit.

1. Remove Spacer Ring from Setting Fixture.

2. Reposition Locating Pin as required (see Figure 2-12).

Fixture is factory set to accommodate all but smallest Cutting Heads. Locating Pin extends 1.75 in. (44,5 mm) from base of Fixture. For Cutting Heads in the .937 to 1.125 in. (24 to 28,5 mm) range, Locating Pin will need to be lowered so it only extends 1.5 in. (38 mm) from base. Loosen Set Screw in the side of Fixture and raise or lower Pin as required. Tighten Set Screw.

3. Slide Setting Plug, large diameter end up, on Locating Pin (see Figure 2-13).

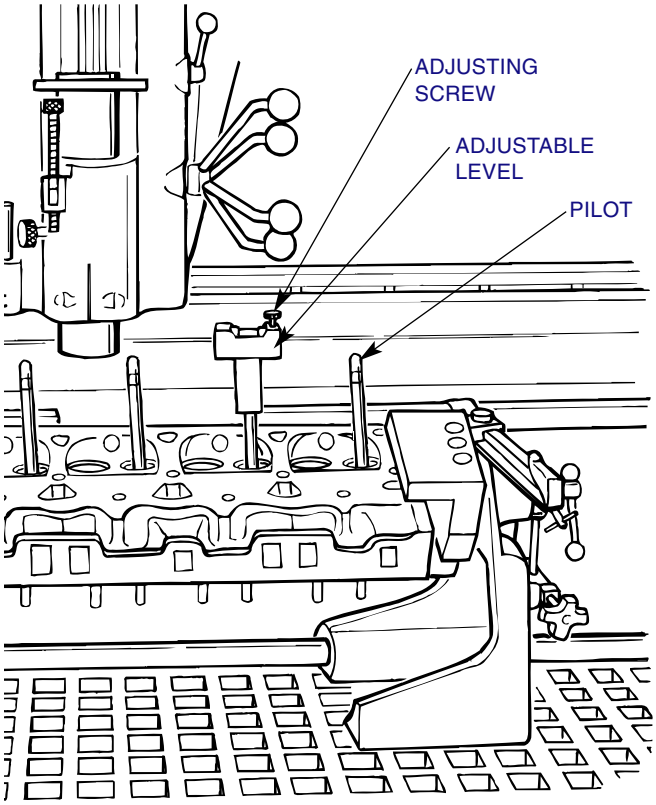


FIGURE 2-10, Align Adjustable Level

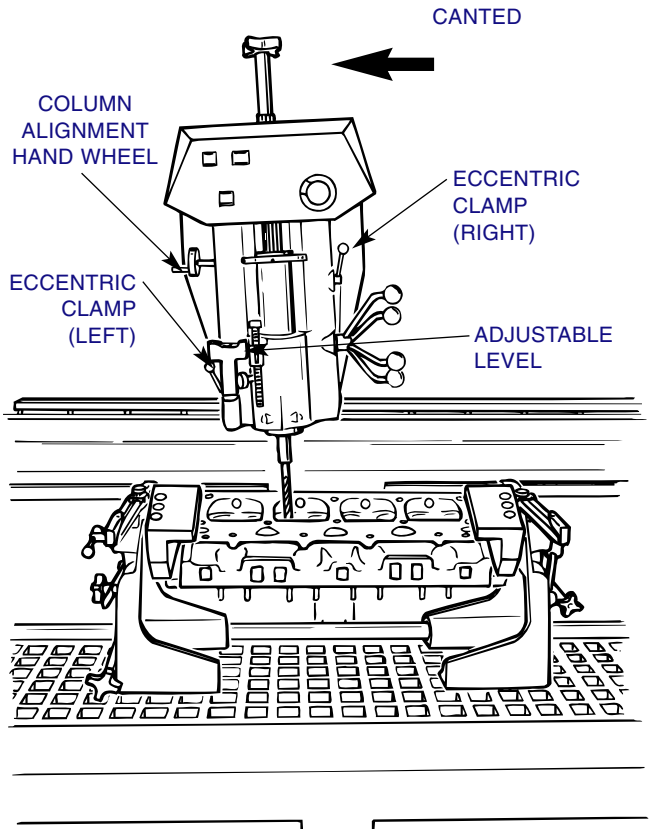


FIGURE 2-11, Align Power Head (Canted)

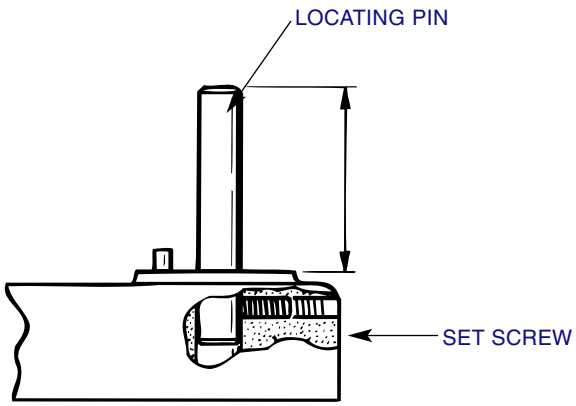


FIGURE 2-12, Locating Pin

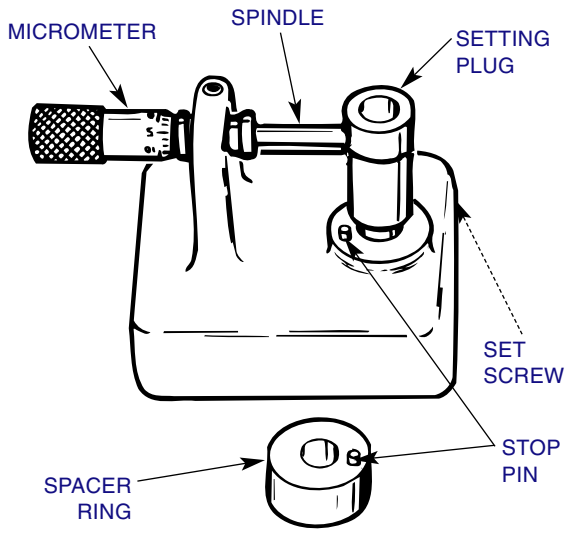


FIGURE 2-13, Setting Fixture

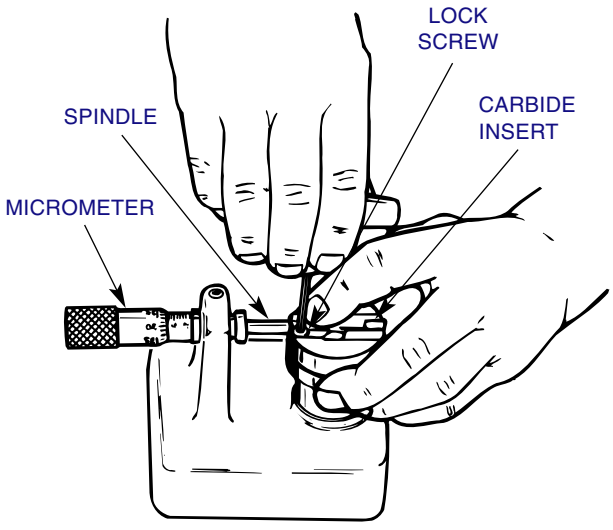


FIGURE 2-14, Set Seat Pocket Cutter

4. Turn Micrometer until Spindle just touches Setting Plug. Fixture should read Zero. If Fixture does not read Zero, back off Micrometer and use a Wrench to adjust Sleeve. Recheck and readjust as required.

5. Back off Micrometer and remove Setting Plug.

6. Reinstall Spacer Ring on Fixture. Ring should drop over Stop Pin in Fixture.

NOTE: Spacer Ring is NOT needed with Cutting Heads in the .987 to 1.125 in. (24 to 28,5 mm) range, which have longer shanks.

7. Set Micrometer to desired Seat Pocket size and then back off .010 to .015 in. (0,3 to 0,4 mm).

8. Clean Cutting Head.

9. Loosen Lock Screws and install Carbide Inserts in Cutting Head.

10. Slide Cutting Head on Locating Pin and snap in place. Notch in Head should engage Stop Pin on Fixture (see Figure 2-14).

11. Rotate Cutting Head (clockwise) and hold against Stop Pin so cutting edge of one of Carbide Inserts is positioned on center of Spindle.

12. Push Carbide Insert outward so cutting edge is against Spindle. Use Index Finger to push Insert against Spindle, while holding Cutting Head firmly in position against Stop Pin with Thumb and Middle Finger.

13. While holding Carbide Insert against Spindle, run Micrometer down to size. Tighten Lock Screw.

14. Back Micrometer off slightly (.015 in. / 0,4 mm) so Carbide Insert will clear Spindle.

15. Raise Head slightly to clear Stop Pin and rotate Head 180º to align cutting edge of remaining Carbide Insert with Spindle.

16. Repeat steps 12 and 13 for second Carbide Insert.

17. Check settings and readjust Carbide Inserts as required:
While holding Head against Stop Pin, turn Micrometer until Spindle just touches cutting edge of Carbide Insert. Insert should be set to within .0005 in. (0,012 mm) of desired Seat Pocket diameter.
Back off Micrometer, rotate Head and check opposite Insert. Both Inserts should be within .0005 in. (0,012 mm) of each other. Readjust as required.

18. Remove Cutting Head from Fixture.

SEAT ANGLE CUTTER (VGS)

To set three-blade VGS Seat Angle Cutter which uses three interchangeable blades, proceed as follows:

NOTE: Setting Fixture is included in Sunnen VGS Seat Angle Cutting Kit.

1. Place Setting Fixture on bench as illustrated in Figure 2-15.

2. Loosen Setting Plate Knob and remove Setting Plate.

3. Select Corner Angle for Valve Seat (port) to be reconditioned (refer to Table 2-3). Install Setting Plate in Fixture so desired Corner Angle is positioned as shown in Figure 2-15. Do not tighten Knob.

4. Slide Stop Block to outside edge of Setting Fixture so it will not interfere with setting of Fixture.

5. Loosen Knurled Knob and slide Magnetic Locator to outside edge of Fixture.

6. Loosen Pilot Knob and remove Threaded Pilot from Pilot Clamp.

7. Select a properly ground Valve and insert in Pilot Clamp.

8. While holding Valve in Fixture, slide both Valve and Setting Plate inward until Valve Face Angle contacts Corner Angle of Setting Plate.

NOTE: Setting Plate should contact Valve at same point on Face Angle (Line Of Contact), as Valve is to contact Valve Seat (see Figure 2-16).

9. Tighten Setting Plate Knob.

10. Hold Valve in Fixture and recheck location of Corner Angle on valve Face. Readjust Setting Plate as required.

CAUTION

DO NOT loosen Setting Plate Knob until Seat Angle Cutter has been set.

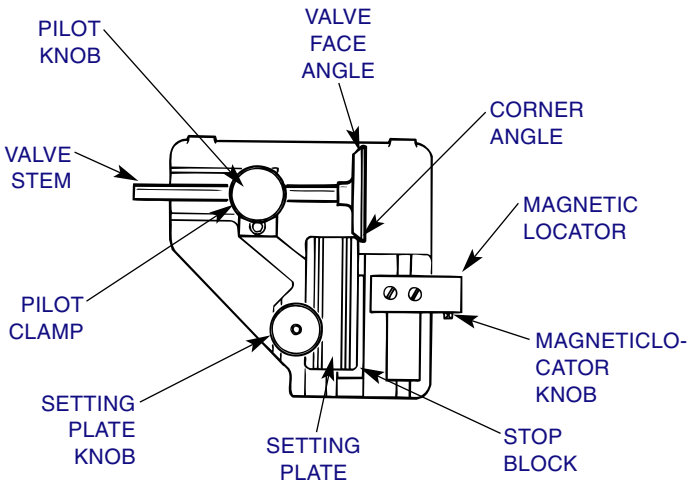
11. Remove Valve from Clamp.

12. Reinstall Threaded Pilot in Pilot Clamp so end of Threaded Pilot is flush with end of Fixture. Tighten Pilot Knob.

13. Slide Stop Block inward, so edge of Block is approximately 1/4 in. (6 mm) past inside edge of Setting Plate (see Figure 2-17).

14. Using 1/8" T-Wrench as a gauge, position Magnetic Locator as follows (see Figure 2-18):

Place flat side of T-Wrench against Magnetic Locator as illustrated and slide Magnetic Locator inward until edge of T-Wrench is lined up with the edge of Corner Angle of Setting Plate. Tighten Knurled Knob.



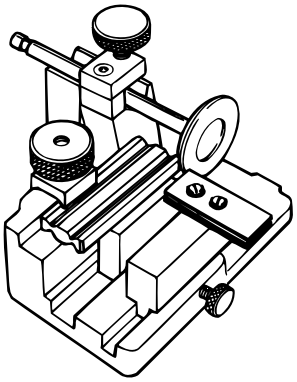
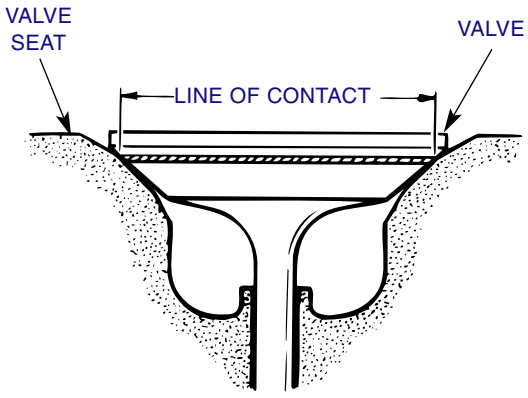


FIGURE 2-15, Setting Fixture (3-Blade Cutter)



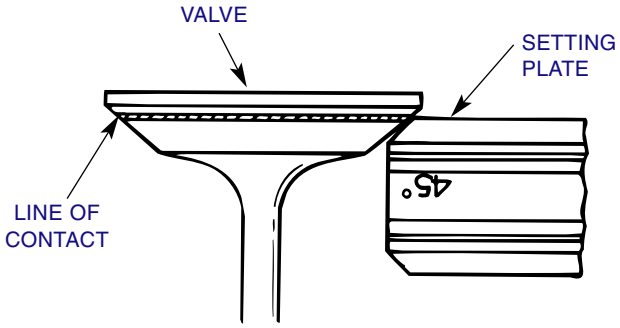


FIGURE 2-16, Line of Contact

TABLE 2-3, Setting Plate

	PORT		ANGLE
	in	mm	
INTAKE	1/16	1,5	30º 45º
EXHAUST	3/32	2,5	30º 45º

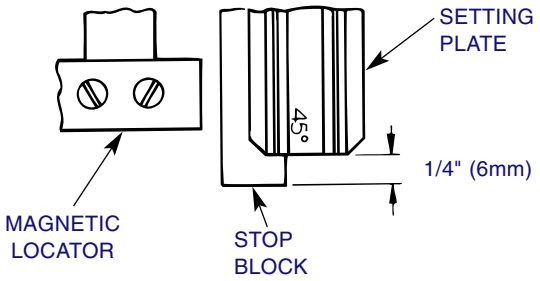
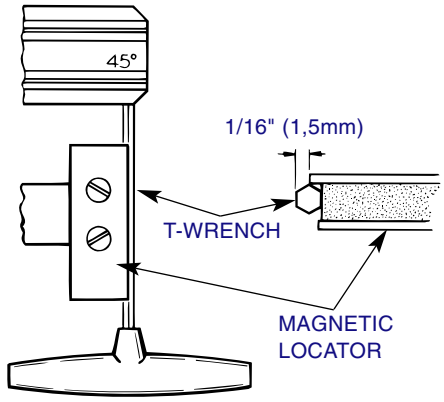


FIGURE 2-17, Set Stop Block



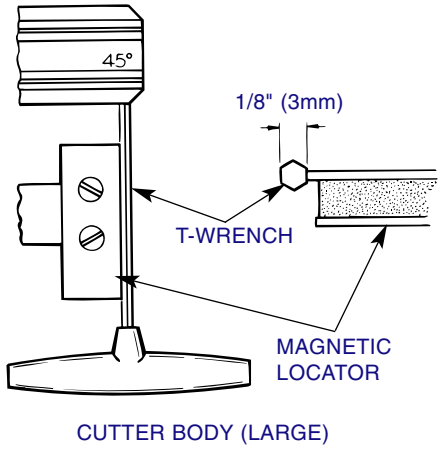


FIGURE 2-18, Set Magnetic Locator

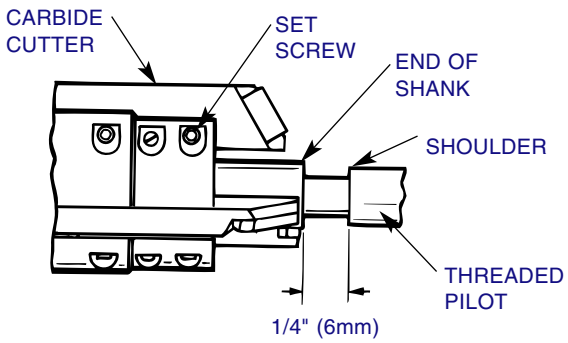


FIGURE 2-19, Install Carbide Cutter

15. Select Seat Angle Cutter. For Valve Seats over 2 in. (50 mm) in diameter use large Cutter Body, and for those 2 in. (50 mm) or less use small Cutter Body.

16. Loosen Set Screws and remove Carbide Cutters from Cutter Body.

17. Select Carbide Cutters for Top, Seat and Throat Angles. DO NOT mix Carbide Cutters. Standard Cutters come in 3/8 in. (9,5 mm) and 1/2 in. (13 mm) widths.

18. Clean Carbide Cutters and Cutter Body.

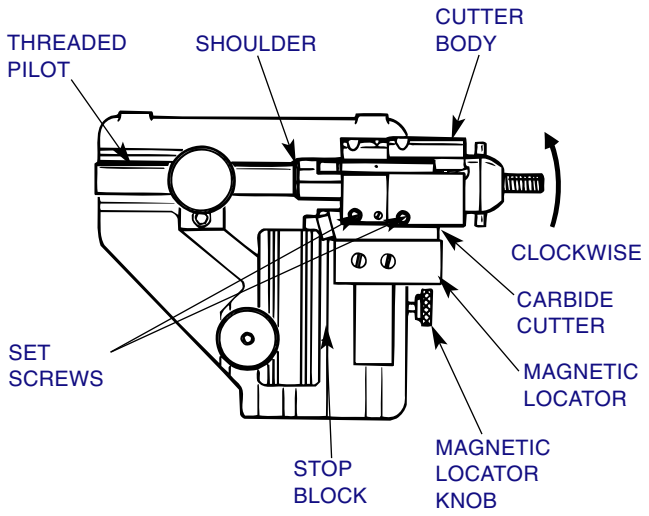
19. One at a time, insert a Cutter into one of the Tool Slots in Cutter Body so the edge of the Cutter is lined up with end of the Body Shank (see Figure 2-19). Lightly tighten one Set Screw to hold Cutter in place.

20. Slide Cutter Body on Threaded Pilot until it contacts Shoulder of Threaded Pilot; then slide Body back approximately 1/4 in. (6 mm).

21. Rotate Body counterclockwise until Carbide Cutter rests on Stop Block (see Figure 2-20).

22. Loosen Set Screw and allow Carbide Cutter to be pulled up against Magnetic Locator. Lightly tighten one Set Screw.

23. Slide Cutter Body forward until you feel Carbide Cutter touch Corner Angle of Setting Plate.



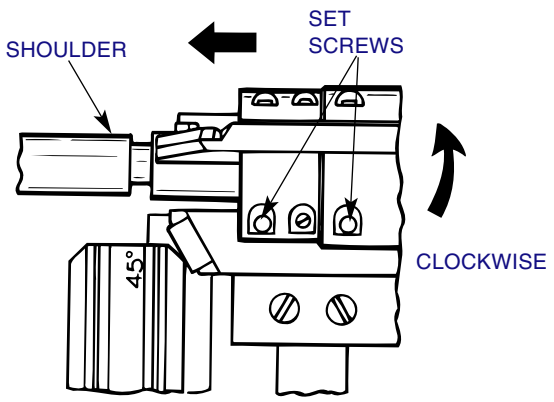


FIGURE 2-20, Set Seat Angle Cutter

24. Loosen Set Screw and slide Cutter Body forward until it contacts Pilot Shoulder. Then lock Carbide Cutter in place by lightly tightening BOTH Set Screws in Cutter Body.

25. Slide Cutter Body out to end of Threaded Pilot and rotate Body counterclockwise until next Carbide Cutter is in position.

26. Repeat step 20 through 25 for two (2) remaining Carbide Cutters.

27. Use end of T-Wrench to push Stop Block back.

28. Loosen Magnetic Locator Knob and slide Magnetic Locator back.

29. Slide Cutter Body forward until it contacts Pilot Shoulder.

30. Rotate Body clockwise to check all Carbide Cutters. Each Cutter should just touch Corner Angle while Cutter Body is in contact with Shoulder of Threaded Pilot. Readjust as required.

31. Remove Seat Angle Cutter from Setting Fixture.

32. Tighten all Set Screws securely.

SEAT ANGLE CUTTER (VSC)

To set single-blade VSC Seat Angle Cutter which uses a single preset three angle blade, proceed as follows:

NOTE: Setting Fixture is included in Sunnen VSC Seat Angle Cutter Kit.

1. Place Setting Fixture on work bench as illustrated (see Figure 2-21).

2. Loosen Pointer Knob and swing Pointer to the side.

3. Loosen Ball Plunger Knob.

4. Select a properly ground Valve and insert in Fixture's V-Clamp.

5. Turn Ball Plunger Knob clockwise until tight; then back off 1/8 turn counterclockwise.

6. Position Valve and Pointer, so Pointer contacts Valve as illustrated, and tighten Pointer Knob (see Figure 2-22).

CAUTION

DO NOT loosen Pointer Knob until Seat Angle Cutter is set.

7. Loosen Ball Plunger Knob and remove Valve.

8. Measure Valve Stem to determine approximate Pilot size.

9. Insert Pilot in Fixture's V-Clamp, so Shoulder of Pilot is approximately 1/2 in. (12 mm) from edge of V-Clamp as illustrated. Then tighten Ball Plunger Knob (see Figure 2-23).

10. Select Seat Angle Cutter (see Table 2-4).

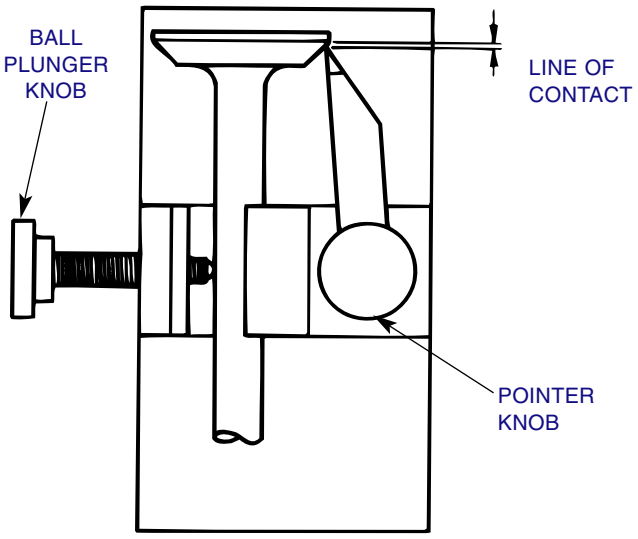


FIGURE 2-21, Setting Fixture (Single-Blade Cutter)

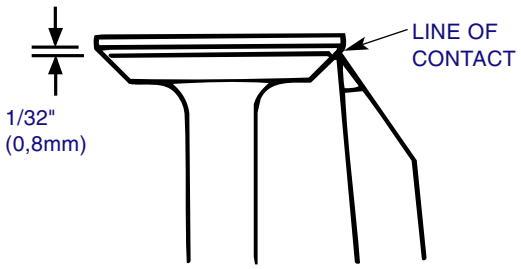


FIGURE 2-22, Line of Contact

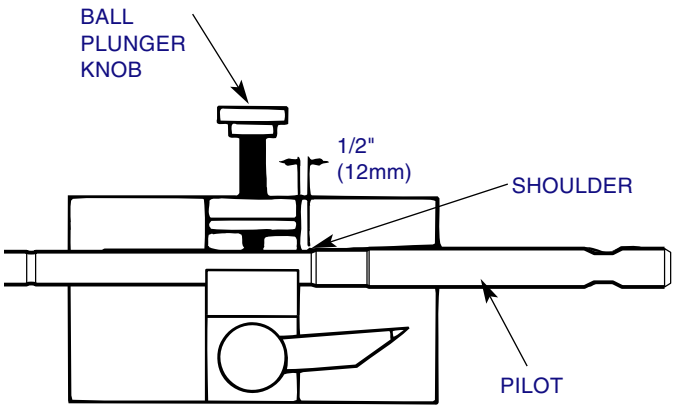


FIGURE 2-23, Insert Pilot

TABLE 2-4, Seat Angle Cutters

DIAMETER		CUTTER BODY
INCHES	MILLIMETERS	
1.0 to 1.6	25 to 41	Small-VSC-205
1.5 to 2.0	38 to 52	Medium-VSC-305
1.9 to 2.5	47 to 64	Large-VSC-350

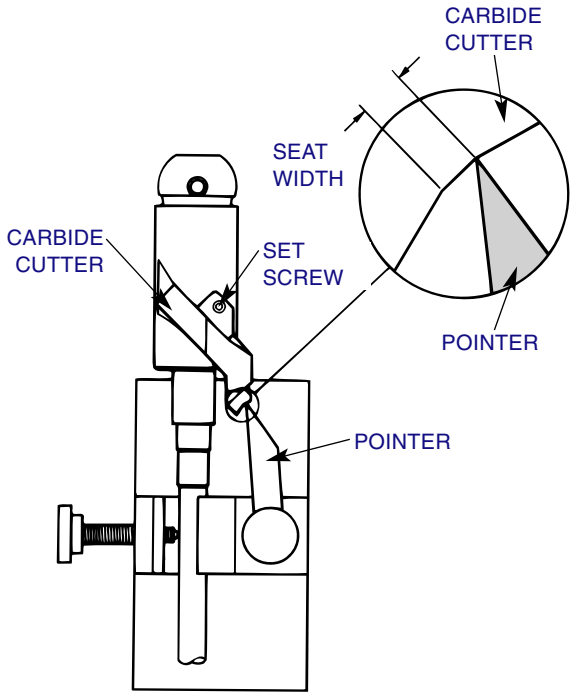


FIGURE 2-24, Setting Seat Angle Cutter

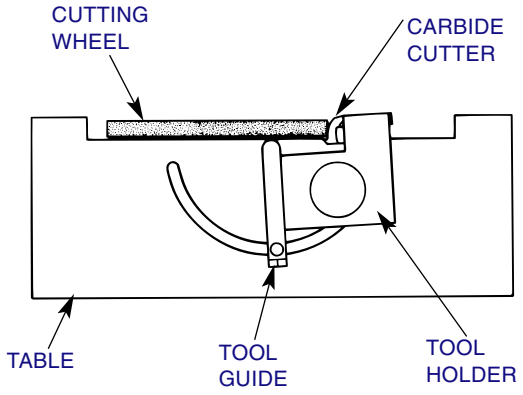


FIGURE 2-25, Tool Sharpening Fixture

11. Loosen Set Screw and remove Carbide Cutter from Cutter Body.

12. Select proper Carbide Cutter for Seat Angle to be cut. Cutters are available in a variety of standard cutter sizes. (Refer to Automotive Catalog for complete list.)

13. Clean both the Carbide Cutter and the Cutter Body.

14. Insert the Carbide Cutter into the Cutter Body and lightly tighten the Set Screw.

15. Slide Cutter Body on Pilot.

16. Loosen Set Screw and position Carbide Cutter so Pointer contacts Cutter as illustrated (see Figure 2-24). Tighten Set Screw.

17. Recheck setting, readjust as required, then remove Cutter Body from Fixture.

NOTE: A Tool Sharpening Fixture is included in Kit. To Sharpen VSC Carbide Cutter, refer to the Instructions packed with Sunnen TS-100 Tool Sharpener (see Figure 2-25), or refer to Section 4.

NOTES

SECTION 3
SETUP AND OPERATION

GENERAL

This section gives step-by-step operating procedures for Sunnen VGS-20 Valve Guide and Seat Machine.

SAFETY PRECAUTIONS

The following precautions should be observed to ensure maximum safety while working on or around Machine.

1. Wear proper Safety Items (such as safety glasses and other personal safety equipment as necessary or required).

2. DO NOT wear loose fitting clothes or jewelry while working on or around Machine.

3. Use proper lifting procedures when moving Cylinder Head.

4. Use care when installing and/or removing Cylinder Head from Machine. Lock Head Support Assembly before loading or unloading Cylinder Head.

5. Keep area around Machine free of paper, oil, water and other debris at all times.

6. Keep Machine and area cleaned of excessive lubricant and lubricant spills.

7. Keep Machine clear of tools and other foreign objects.

8. Keep tools clean and in their proper storage compartments to maintain them in proper working condition and to prolong tool life.

9. Inspect tooling for cracks, burrs or bent parts that might affect operation. Inspect Carbide Inserts (Seat Pocket Cutter) and Carbide Cutters (Seat Angle Cutter) to ensure they are sharp, firmly attached and are not damaged.

10. DO NOT force tools when operating. Tools will do a better and safer job when operated at speed rate for which they were designed.

11. Turn OFF electrical power when performing service on your machine, if service does not require power.

12. High Voltage exists inside Electrical Control Enclosure – use caution when working on or around Enclosure. Machine must be disconnected from main power supply before any work can be performed inside of Enclosure.

13. CE Machine must ONLY be operated with all Safety Guards in place and locked. DO NOT remove or alter Guards.

OPERATING TIPS

1. DO NOT depress Foot Pedal once setup is completed as this will change Machine and Cylinder Head alignment.

2. CUT SEAT POCKET, INSTALL INSERT, CUT SEAT ANGLES AND MEASURE RUNOUT OF VALVE SEAT BEFORE MOVING PILOT. This assures that pilot axis will remain constant during all operations.

3. Important – Keep Spindle clean and dry. DO NOT OIL.

VALVE GUIDE INSERTS

To install valve guide inserts proceed as follows:

Consult your local Sunnen Field Service Engineer when ordering tooling for your Machine. To drill out old guides and install replacement guide inserts requires Sunnen Valve Guide Installation Kit and assorted VGS Tooling.

NOTE: If valve guides are so badly worn that guide alignment is impossible, it will be necessary to use Sunnen Worn Guide Alignment Fixture to level and align Cylinder Head with Power Head and to redrill worn valve guide concentric with valve seat. Refer to Instructions packaged with Sunnen Worn Guide Alignment Fixture when reconditioning worn valve guides.

1. Remove any Tooling from Spindle.

2. Install Cylinder Head in Head Support Assembly (refer to Section 2).

3. To determine Core Drill size, measure valve guides using Sunnen P-300 Valve Guide Gage.

4. Select Core Drill for diameter of guide to be drilled (refer to step 3). With ground Flat toward Set Screws, install Drill in Spindle Adapter up to Ring (or Shoulder) on drill shank (see Figure 3-1). Tighten two (2) Set Screws in Adapter.

5. Select Piloted Reamer for diameter of Core Drill selected and install in a second Spindle Adapter.

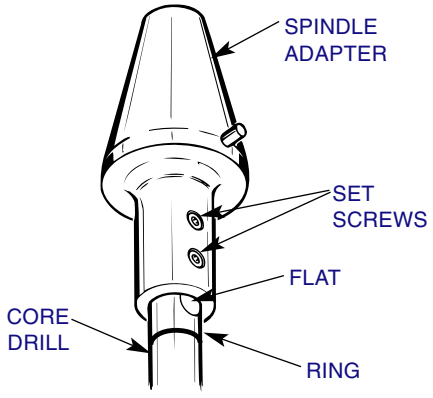


FIGURE 3-1, Install Core Drill

6. Install Spindle Adapter as follows (see Figure 3-2):

Turn Feed Lever Wheel clockwise to fully retract Spindle in Spindle Guide Housing, (until Spindle stops its upward movement).

Insert Adapter in bottom of Spindle; and while pushing up on Adapter, rotate Adapter to the left until Drawbar drops into place. Then rotate Adapter to the right 1/4 turn.

Tighten Drawbar Knob on top of Drawbar to lock Adapter in place. DO NOT overtighten.

7. Clean valve guide with a brush to remove foreign matter.

8. Depress Foot Pedal and float Power Head so Core Drill is located over valve guide to be drilled.

9. Use Feed Lever Wheel to run Core Drill down until Pilot just enters valve guide (see Figure 3-3). Tighten Spindle Lock.

10. Release your hands from Power Head to allow Head to stabilize and Drill to center itself in guide.

CAUTION

DO NOT depress Foot Pedal during drilling operation, as this will change Machine and Cylinder Head alignment.

11. Release Foot Pedal.

12. Select Spindle Speed according to Table 3-1 and set Speed Control Dial.

NOTE: Spindle Speeds shown in following table are offered as a suggested starting point. Actual operating speeds may vary according to material of valve guides to be drilled.

13. Loosen Spindle Lock and retract Core Drill slightly so Pilot is not in guide when Machine is started.

14. Depress START Button. Readjust Spindle Speed as required.

15. Run Drill down through Valve Guide at a steady feed rate, until Core Drill has completely cleared bottom of guide (see Figure 3-4).

16. Retract Drill and depress STOP Button.

17. Repeat core drilling operation on remaining valve guides (refer to steps 7–16).

CAUTION

Core Drill may become hot during core drilling operation.

18. Remove Core Drill Adapter from Spindle and install Reamer Adapter.

19. Clean valve guides with brush to remove any metal chips.

20. Depress Foot Pedal and float Power Head so Piloted Reamer is located over valve guide.

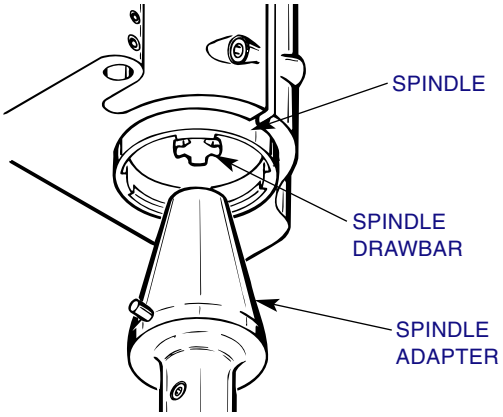
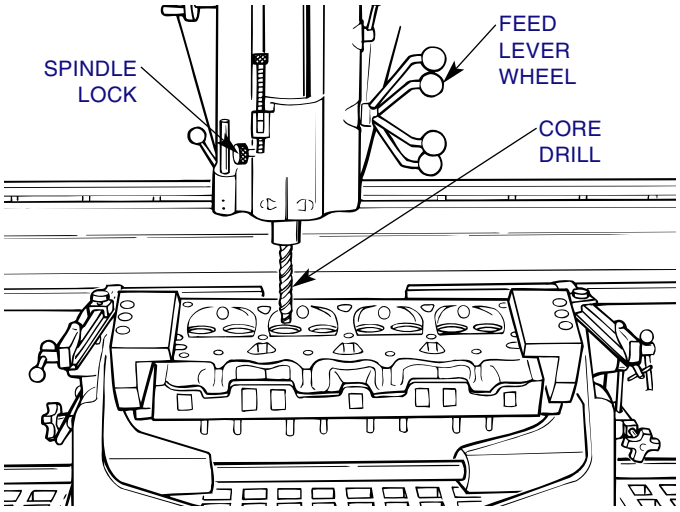


FIGURE 3-2, Install Spindle Adapter



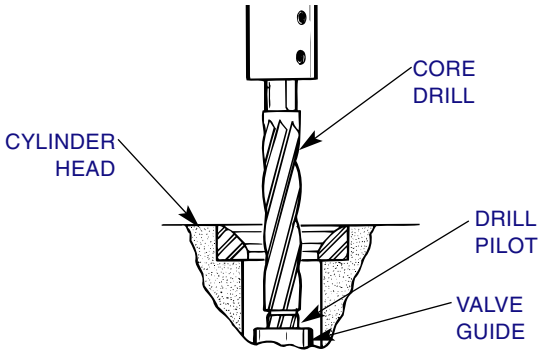


FIGURE 3-3, Align Core Drill

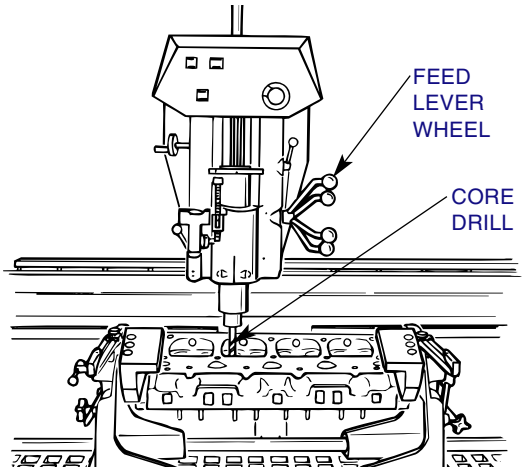
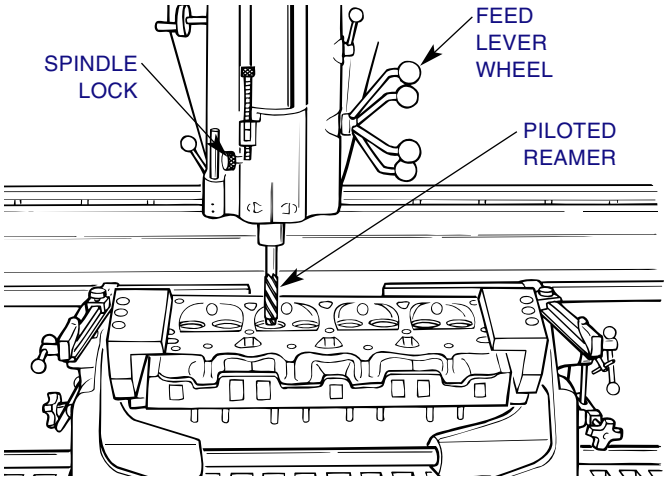


FIGURE 3-4, Drill Valve Guide

TABLE 3-1, Suggested Spindle Speeds

DIAMETER		SPEED (RPM)	
in	mm	DRILLING	REAMING
1/4	6,0	425	425
5/16	8,0	425	425
11/32	9,0	425	425
3/8	9,5	425	425
7/16	11,0	425	400
1/2	12,5	425	350
9/16	14,0	425	300
5/8	16,0	425	275



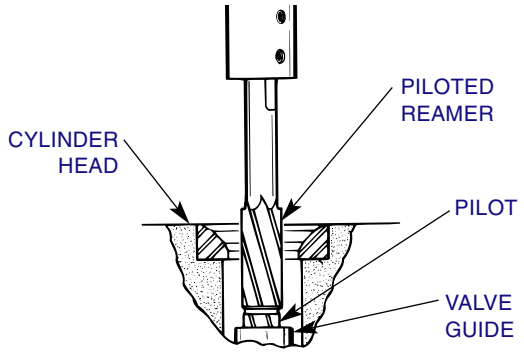


FIGURE 3-5, Align Piloted Reamer

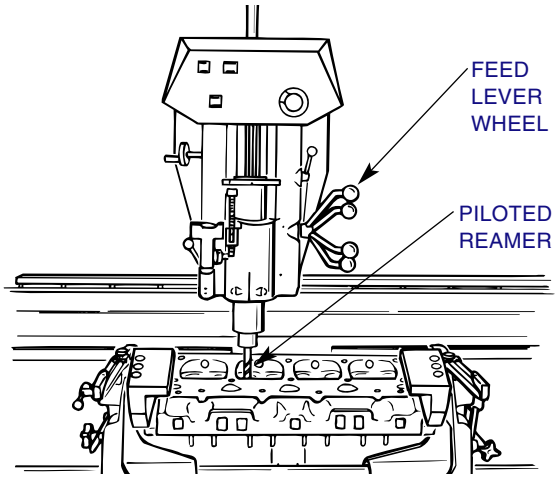


FIGURE 3-6, Ream Valve Guide

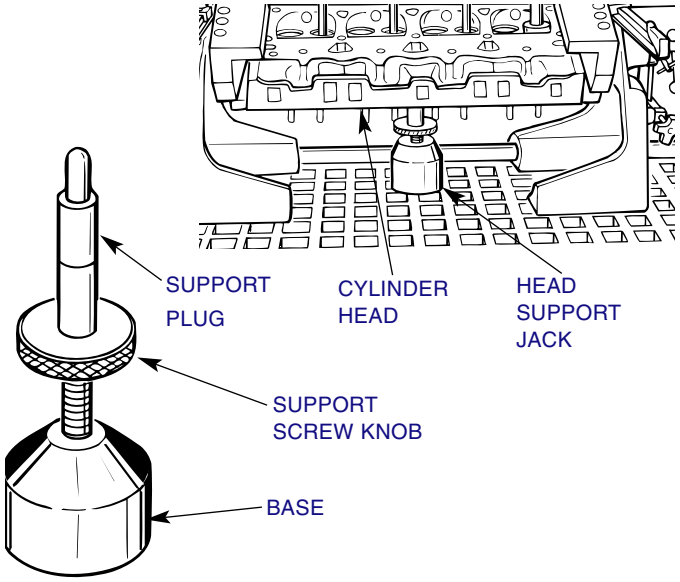


FIGURE 3-7, Install Head Support Jack

21. Use Feed Lever Wheel to run Spindle down until Pilot on Piloted Reamer just enters Valve Guide which has been core drilled (see Figure 3-5). Tighten Spindle Lock.

22. Release your hands from Power Head to allow Head to stabilize and Piloted Reamer to center itself in guide.

CAUTION

DO NOT depress Foot Pedal during reaming operation, as this will change Machine and Cylinder Head alignment.

23. Release Foot Pedal.

24. Select Spindle Speed according to Table 3-1 and set Speed Control Dial.

25. Loosen Spindle Lock and retract Piloted Reamer slightly so Pilot is not in guide when Machine is started.

26. Depress START Button. Readjust Spindle Speed as required.

27. Run Piloted Reamer down through Valve Guide at a steady feed rate, until Reamer has completely cleared bottom of guide (see Figure 3-6).

28. Retract Piloted Reamer and depress STOP Button.

29. Repeat Reaming operation on remaining Valve Guides (refer to steps 19–28).

CAUTION

Piloted Reamer may become hot during reaming operation. Use a shop towel or a glove when removing Adapter from Spindle.

30. Remove Adapter from Spindle.

31. Depress Foot Pedal and float Power Head to one end of Machine.

32. Install Head Support Jack under center of Cylinder Head (see Figure 3-7) to reduce vibration and chatter.

33. Select proper replacement Guide Inserts and Guide Driver (see Figure 3-8).

34. Clean pre-drilled valve guides with brush to remove metal chips.

35. Lubricate OD of Guide Insert and ID of pre-drilled Valve Guide with Sunnen B-200 Lubricant.

36. Position Insert in pre-drilled valve guide.

37. While holding Driver and Insert in position, use Air Hammer to drive Insert into Cylinder Head (see Figure 3-9).

38. Install replacement Guide Inserts in remaining pre-drilled valve guides (refer to steps 33 thru 37).

39. Remove Head Support Jack.

40. Check alignment of Cylinder Head (refer to Section 2), and realign as required.

41. Measure ID of replacement guide inserts, using Sunnen Valve Guide Gage.

42. Select Spotfacer for OD of guide inserts to be refaced. Select a Guide Pilot for ID of guide insert (refer to step 41) and install in Spotfacer (see Figure 3-10).

43. Install Spotfacer in Spindle Adapter, with ground flat toward Set Screws, up to Ring on drill shank. Tighten two (2) Set Screws in Adapter.

44. Install Spindle Adapter in Spindle (see Figure 3-11).

45. Depress Foot Pedal and float Power Head so Spotfacer is located over first guide insert to be spot-faced.

NOTE: If not all valve guides have been replaced with guide inserts, float Power Head so Spotfacer is located over an existing valve guide which has not been replaced.

---

46. Use Feed Lever Wheel to run Spindle down until Guide Pilot on Spotfacer just enters valve guide; then tighten Spindle Lock.

47. Release your hands from Power Head to allow Head to stabilize and Guide Pilot to center itself in guide (see Figure 3-12).

CAUTION

DO NOT depress Foot Pedal during spot-facing operation, as this will change Machine and Cylinder Head alignment.

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48. Release Foot Pedal.

49. Select Spindle Speed according to Table 3-2 and set Speed Control Dial.

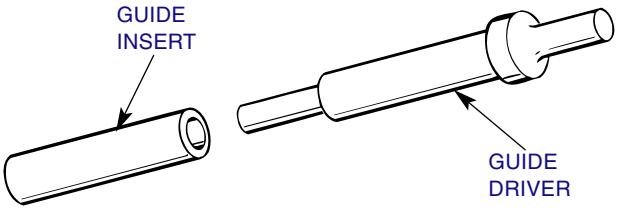


FIGURE 3-8, Select Guide Driver

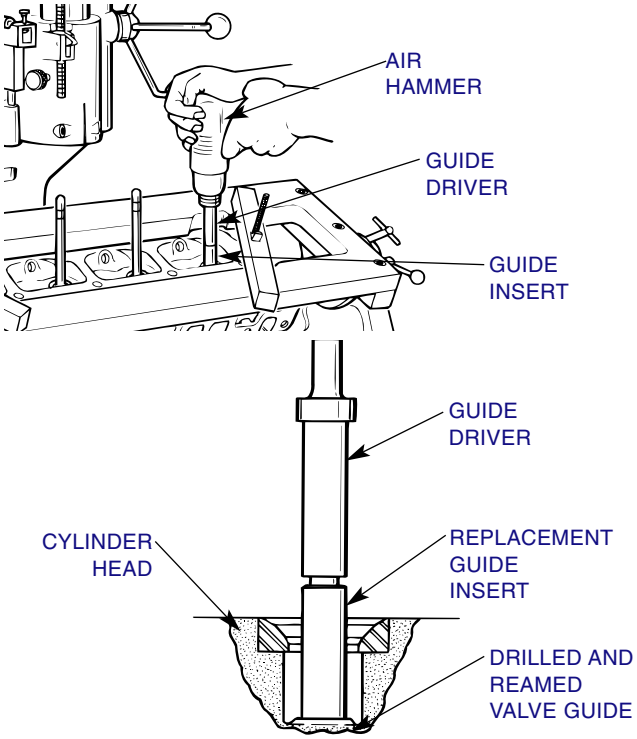


FIGURE 3-9, Install Guide Insert

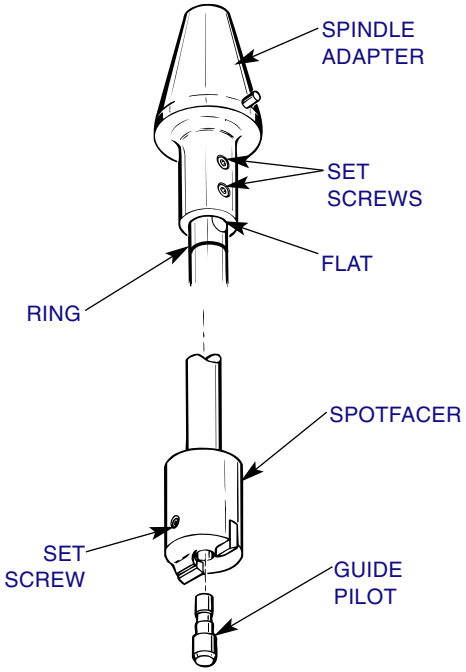


FIGURE 3-10, Install Spotfacer

TABLE 3-2, Suggested Spindle Speeds

DIAMETER in	DIAMETER mm	SPEED (RPM) SPOTFACING
5/16	8,0	325
11/32	9,0	300
3/8	9,5	300
7/16	11,0	300
1/2	12,5	300
9/16	14,0	275
5/8	16,0	275
11/16	17,5	275
3/4	19,0	250
13/16	20,5	250
7/8	22,0	250
15/16	24,0	225
1	26,0	225

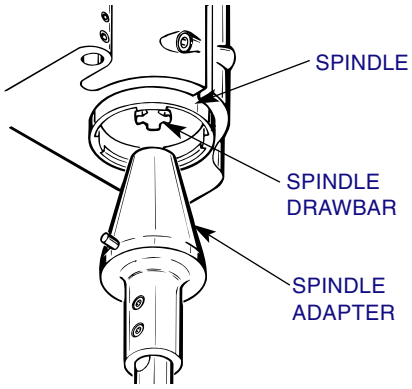


FIGURE 3-11, Install Spindle Adapter

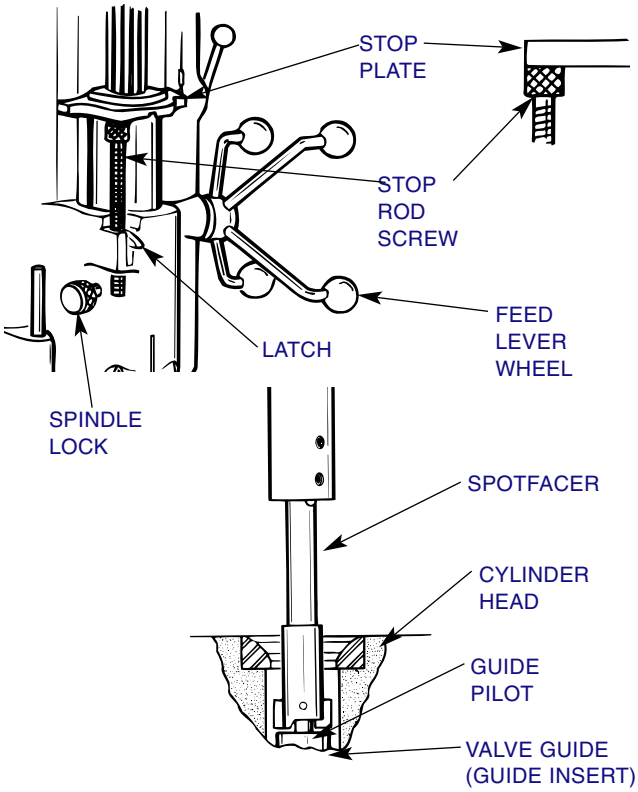


FIGURE 3-12, Align Spotfacer

NOTE: Spindle Speeds shown in following table are offered as a suggested starting point. Actual operating speeds may vary according to material of valve guides to be cut.

50. If not all valve guides have been replaced with guide inserts, float Power Head so Spotfacer is located over existing valve guide and skip to step 56. If all new guide inserts have been installed, proceed with step 51.

51. Loosen Spindle Lock and retract Spotfacer slightly so Carbide Inserts are not contacting Guide Insert when machine is started.

52. Depress START Button. Readjust Spindle Speed as required.

53. Spot-Face first guide insert: Run Spotfacer down at a steady feed rate until Guide Insert has been cut to desired depth (see Figure 3-13).

54. Depress STOP Button.

55. Again, run Spotfacer down until Carbide Inserts lightly touch cut face of Guide Insert and tighten Spindle Lock.

56. Push Stop Rod Screw up against Spindle Stop Plate. This is to ensure all Inserts are cut to a consistent length.

57. Loosen Spindle Lock and retract Spotfacer.

58. Depress Foot Pedal and float Power Head so Spotfacer is located over next guide insert to be spot-faced.

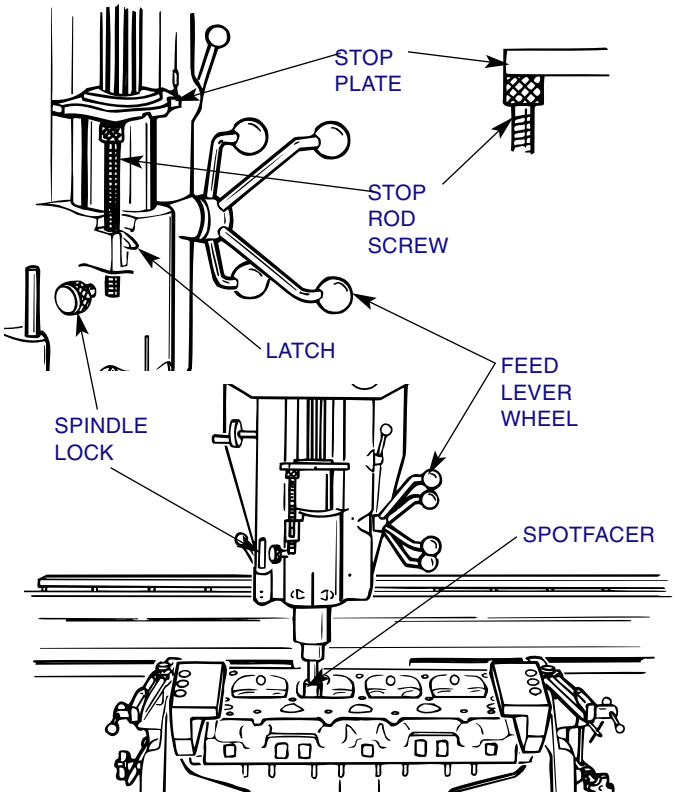


FIGURE 3-13, Spot-Face Guides

59. Use Feed Lever Wheel to run Spindle down until Guide Pilot on Spotfacer just enters valve guide.

60. Depress Start Button and run Spotfacer down at a steady feed rate until Stop Plate contacts Stop Rod Screw (see Figure 3-13).

61. Momentarily hold Spotfacer in full position (for one or two revolutions), then back off Feed Lever Wheel and depress Stop Button.

62. Repeat Spot-Facing operation on remaining Guide Inserts (refer to steps 58 thru 61).

CAUTION

Spotfacer may become hot during spot-facing operation.

63. Remove Adapter from Spindle.

64. Continue with Valve Guide Reconditioning.

VALVE GUIDE RECONDITIONING

To recondition Valve Guides, proceed as follows:

1. Remove any Tooling from Spindle.

2. Install and align Cylinder Head (refer to Section 2).

3. Install replacement Guide Inserts as required (refer to Section 3).

4. To Rose Reamer size, measure valve guides and guide inserts, using Sunnen P-300 Valve Guide Gage.

5. Select proper diameter straight-fluted Rose Reamer according to step 4.

6. Install Rose Reamer in Drill Chuck Adapter and tighten securely using Chuck Key (see Figure 3-14).

7. Install Drill Chuck Adapter in Spindle as follows (see Figure 3-15):

Turn Feed Lever Wheel clockwise to fully retract Spindle in Spindle Guide Housing, (until Spindle stops its upward movement).

Insert Adapter in bottom of Spindle, and while pushing up on Adapter, rotate Adapter to left until Drawbar drops into place. Then rotate Adapter to right 1/4 turn.

Tighten Drawbar Knob on top of Drawbar to lock Adapter in place. DO NOT overtighten.

8. Clean valve guide with brush to remove foreign matter.

9. Depress Foot Pedal and float Power Head so Rose Reamer is located over valve guide to be resized.

10. Use Feed Lever Wheel to run Spindle down until Rose Reamer just enters guide (see Figure 3-16); then tighten Spindle Lock.

11. Release your hands from Power Head to allow Head to stabilize and Reamer to center itself in guide.

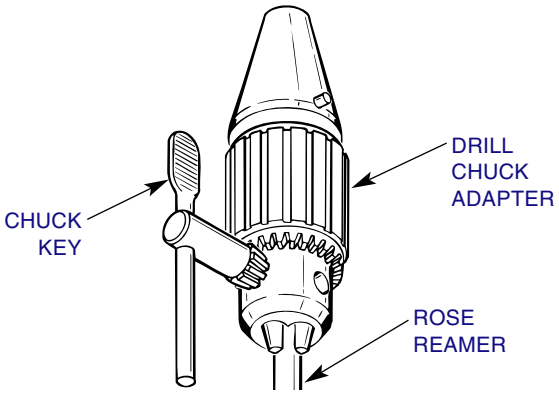


FIGURE 3-14, Install Rose Reamer

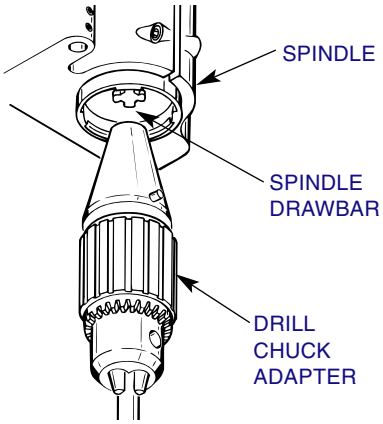


FIGURE 3-15, Install Drill Chuck Adapter

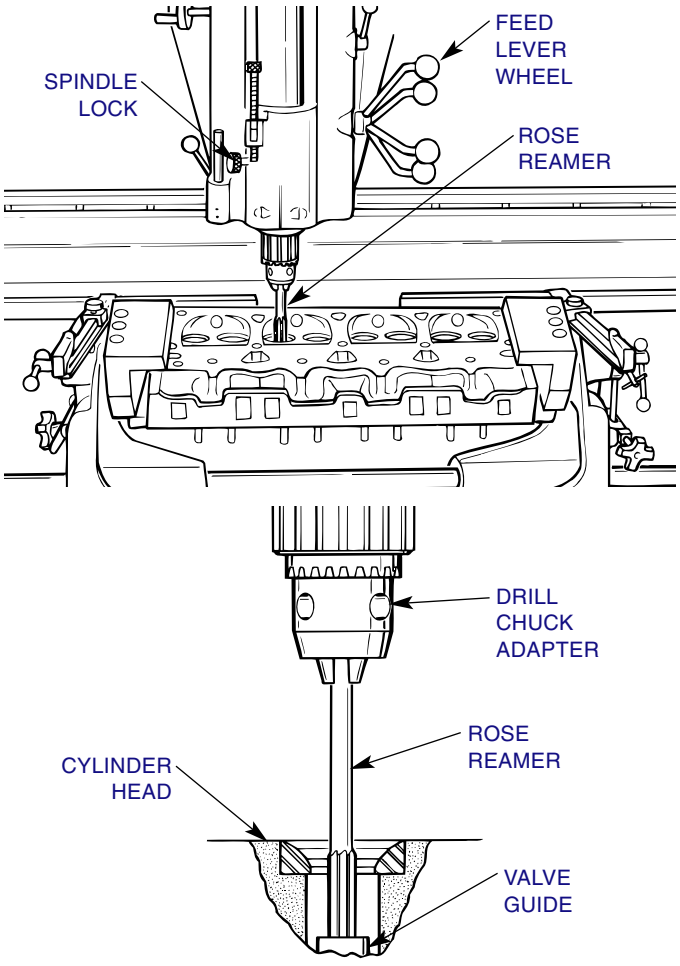


FIGURE 3-16, Align Rose Reamer

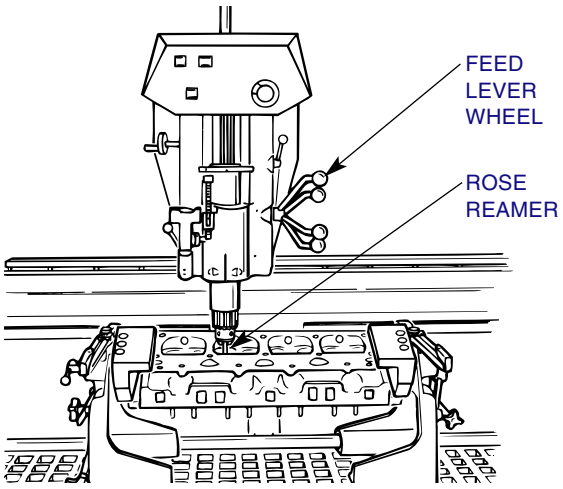


FIGURE 3-17, Size Valve Guide

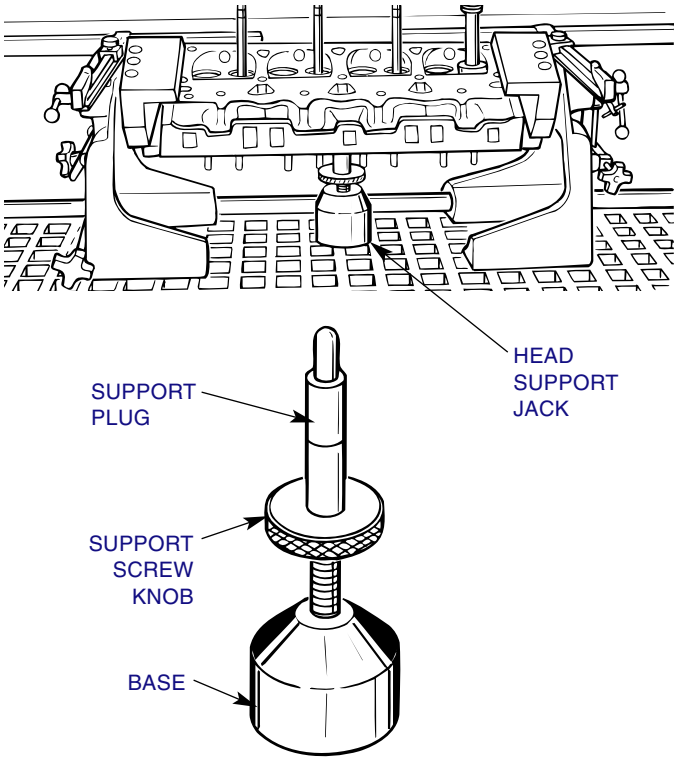


FIGURE 3-18, Install Head Support Jack

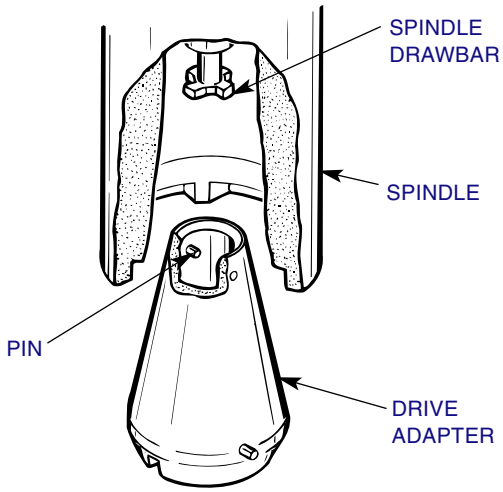


FIGURE 3-19, Install Drive Adapter

TABLE 3-3, Suggested Spindle Speeds

DIAMETER		SPEED (RPM)	
in	mm	DRILLING	REAMING
1/4	6,0	425	425
5/16	8,0	425	425
11/32	9,0	425	425
3/8	9,5	425	425
7/16	11,0	425	400
1/2	12,5	425	350
9/16	14,0	425	300
5/8	16,0	425	275

CAUTION

DO NOT depress Foot Pedal during resizing operation, as this will change Machine and Cylinder Head alignment.

12. Release Foot Pedal.

13. Select Spindle Speed according to Table 3-3 and set Speed Control Dial.

NOTE: Spindle Speeds shown in following table are offered as a suggested starting point. Actual operating speeds may vary according to material of valve guides to be drilled.

14. Loosen Spindle Lock and retract Reamer slightly so it is not in guide when Machine is started.

15. Depress START Button. Readjust Spindle Speed as required.

16. Run Rose Reamer down through Valve Guide at a steady feed rate, until Reamer has completely cleared bottom of guide (see Figure 3-17).

17. Retract Rose Reamer and depress STOP Button.

18. Repeat resizing operation on remaining valve guides (refer to steps 8–17).

CAUTION

Rose Reamer may become hot during resizing operation; be sure to grip Drill Chuck Adapter when removing Assembly from Spindle.

19. Remove Drill Chuck Adapter from Spindle.

VALVE SEAT INSERTS

To install valve seat inserts proceed as follows:

Consult your local Sunnen Field Service Engineer when ordering tooling for your Machine. To bore out old seats and install replacement seat pocket inserts requires Sunnen VGS" Seat Pocket Cutter Kit, Seat Driver Kit and assorted VGS Tooling.

1. Remove any Tooling from Spindle.

2. Install and align Cylinder Head (refer to Section 2).

3. Recondition Valve Guides (refer to earlier step).

4. Install Head Support Jack under Cylinder Head to reduce vibration and chatter (see Figure 3-18).

5. Install Drive Adapter in Spindle as follows (see Figure 3-19):

Retract Spindle using Feed Lever Wheel, until bottom of Spindle is flush with bottom of Spindle Guide Housing.

Insert Adapter in bottom of Spindle, and while pushing up on Adapter, rotate Adapter to left until Drawbar drops into place. Then rotate Adapter to right 1/4 turn.

Tighten Drawbar Knob on top of Drawbar to lock Adapter in place. DO NOT overtighten.

6. Select Cutting Head for diameter of seat pocket to be cut, and install on Seat Body Driver (see Figure 3-20).

NOTE: Refer to Section 2 for instructions on how to set Cutting Heads.

7. Clean valve guides with brush to remove foreign matter.

8. Measure valve guides to determine Pilot size, using Sunnen P-300 Valve Guide Gage.

9. Install Pilots in valve guides of Valve Seats which are to be replaced. Install largest size Pilot that will fit into valve guide. Pilot should not be more than .001 in. (0,03 mm) smaller than valve guide.

10. Slide return Spring on Pilot.

11. Slide Seat Pocket Cutter on Pilot (see Figure 3-21).

12. Depress Foot Pedal and float Power Head so Drive Adapter is located over Seat Pocket Cutter.

13. Use Feed Lever Wheel to run Spindle down until ball socket on Drive Adapter engages Pins on top of Cutter (see Figure 3-22).

14. With Cutter engaged, continue to run Spindle down until Cutting Head lightly touches Cylinder Head. Back off slightly so Carbide Inserts are not contacting Seat, and tighten Spindle Lock.

15. Release your hands from Power Head to allow Head to stabilize and Cutter to center itself on Pilot.

16. Release Foot Pedal.

CAUTION

DO NOT depress Foot Pedal while cutting seat pocket, as this will change Machine and Cylinder Head alignment.

17. Loosen Spindle Lock and run Cutter down until Cutting Head lightly touches Cylinder Head. Retighten Spindle Lock.

18. Select replacement Seat Inserts.

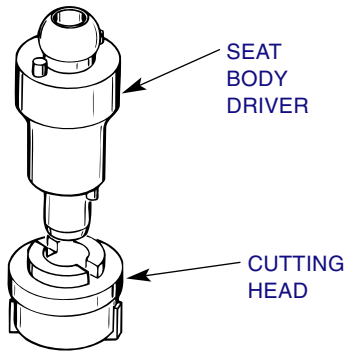


FIGURE 3-20, Select Cutting Head

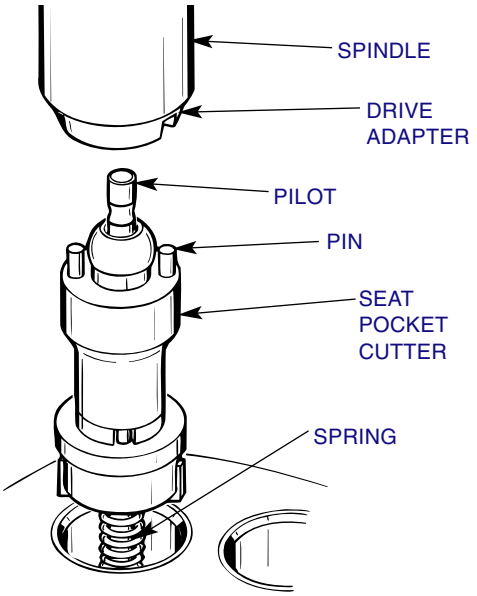
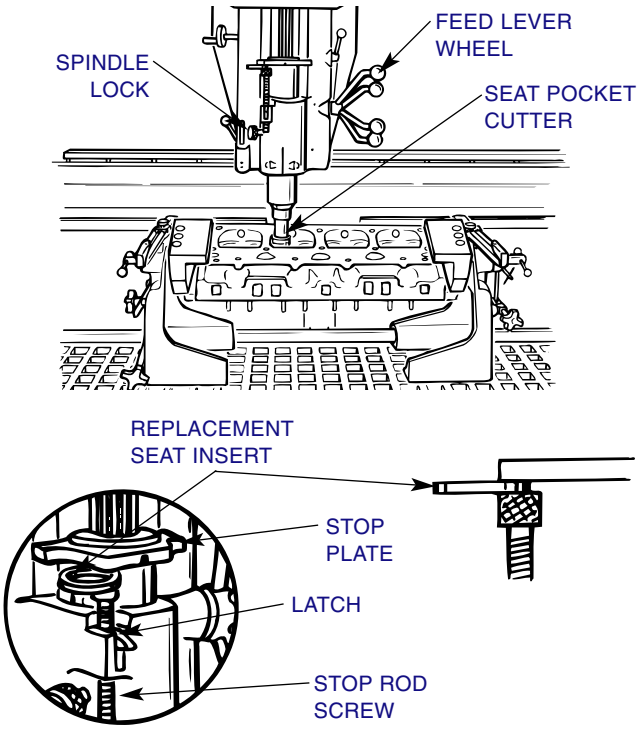


FIGURE 3-21, Install Seat Pocket Cutter

TABLE 3-4, Suggested Cutting Speeds

DIAMETER		SPEED (RPM) SEAT POCKET
in	mm	
15/16	24	225
1	26	225
1-1/8	29	200
1-1/4	32	200
1-3/8	35	175
1-1/2	38	150
1-5/8	41	150
1-3/4	44,5	125
1-7/8	47,5	125
2	51	125
2-1/8	54	100
2-1/4	57	100
2-3/8	60	100
2-1/2	63,5	100
2-5/8	67	75
2-3/4	70	75
2-7/8	73	75
3	76	75



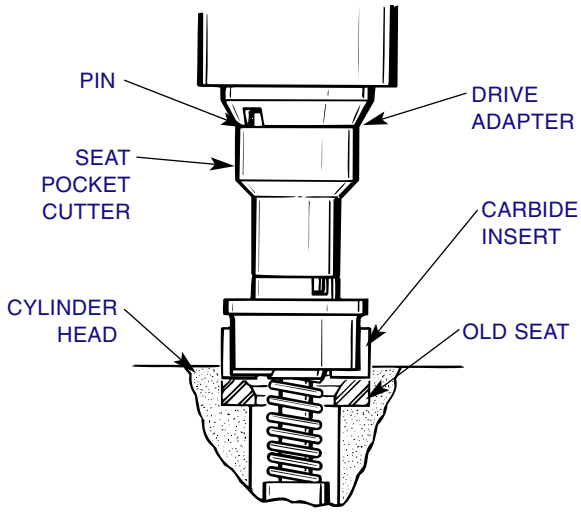


FIGURE 3-22, Align Seat Pocket Cutter

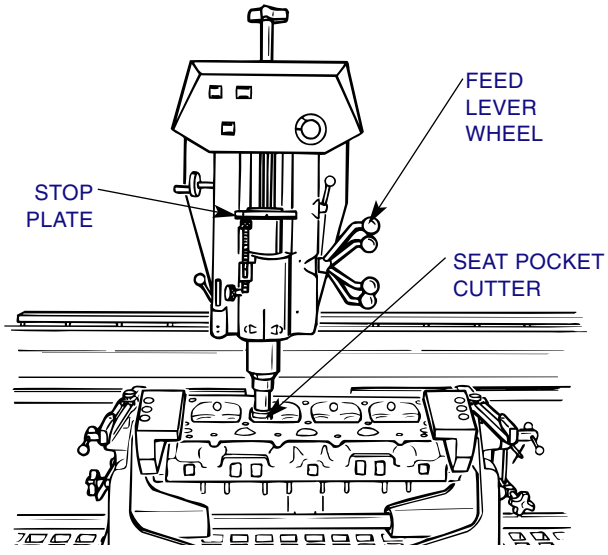


FIGURE 3-23, Cut Seat Pocket

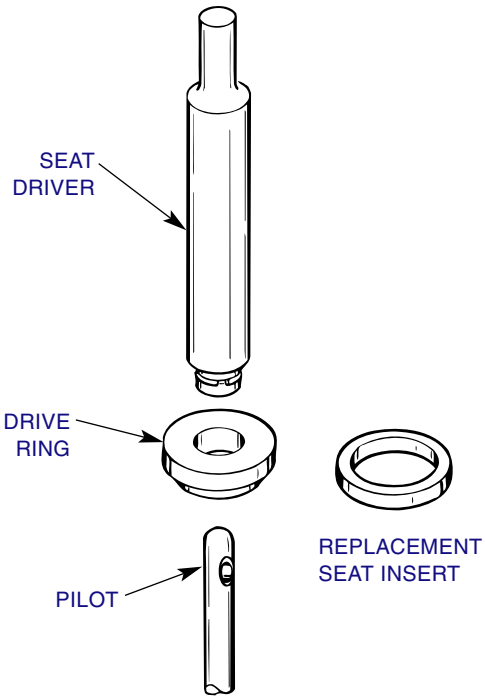


FIGURE 3-24, Select Seat Driver

19. Place replacement Seat Insert against bottom of Stop Plate and push Stop Rod Screw up against Insert. Adjust Stop Rod Screw so Insert is lightly held in place.

20. Remove Insert: Loosen Spindle Lock and retract Cutter slightly to remove insert; then retighten Spindle Lock.

21. Select Spindle Speed according to Table 3-4 and set Speed Control Dial.

NOTE: Spindle Speeds shown in following table are offered as a suggested starting point. Actual operating speeds may vary according to material of seats to be cut.

22. For Cylinder Heads with steel or stellite valve seat Inserts: Brush Seat with an ample supply of Sunnen Cutting Oil to prevent overheating.

23. Loosen Spindle Lock and retract Cutter slightly so Carbide Inserts are not contacting Cylinder Head when Machine is started.

24. Depress START Button and readjust Spindle Speed as required.

25. Cut Seat Pocket: Run Cutter down at a steady feed rate until Stop Plate contacts Stop Rod Screw (see Figure 3-23).

26. Momentarily hold Cutter in full down position (for one or two revolutions), then back off Feed Lever Wheel and depress STOP Button.

CAUTION

DO NOT remove Pilot until complete reconditioning operation has been performed.

27. Remove Cutter and Spring from Cylinder Head. DO NOT remove Pilot.

28. Cut remaining valve seats, as required.

29. Depress Foot Pedal and float Power Head to one end of Machine.

30. Select Drive Ring for size seat insert to be installed and install Drive Ring on Seat Driver (see Figure 3-24).

CAUTION

Seat Pocket must be clean to ensure proper fit and heat distribution of replacement Seat Insert.

31. Brush, vacuum or blow ALL metal chips from Seat Pockets.

32. Position replacement Seat Insert in Seat Pocket and slide Seat Driver down Pilot.

33. While holding Driver and Insert in place, use Air Hammer to drive Insert into Cylinder Head (see Figure 3-25).

34. Remove Driver. DO NOT remove Pilot.

35. Install replacement Seat Inserts in remaining cut Seat Pockets (refer to steps 32 thru 34).

CAUTION

DO NOT remove Pilot until complete reconditioning operation has been performed.

36. DO NOT remove Head Support Jack. Jack should be SNUG against Cylinder Head Casting.

37. Proceed to Valve Seat Reconditioning.

VALVE SEAT RECONDITIONING

To cut valve seat angles proceed as follows:

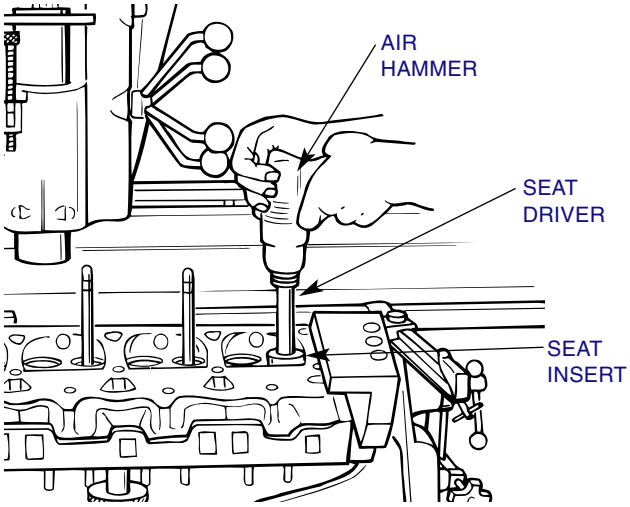
Consult your local Sunnen Field Service Engineer when ordering tooling for your Machine. To cut valve seat angles requires Sunnen VGS or VSC Seat Angle Cutting Kit.

1. Remove any Tooling from Spindle.
2. Install and align Cylinder Head (refer to Section 2).
3. Recondition Valve Guides (refer to Section 3).
4. Cut Seat Pockets and install Seat Inserts as required (refer to Section 3).
5. Install Head Support Jack under Cylinder Head (see Figure 3-26) to reduce vibration and chatter.
6. Install Drive Adapter in Spindle as follows (see Figure 3-27):

Retract Spindle using Feed Lever Wheel, until bottom of Spindle is flush with bottom of Spindle Guide Housing.

Insert Adapter in bottom of Spindle, and while pushing up on Adapter, rotate Adapter to left until Drawbar drops into place. Then rotate Adapter to right 1/4 turn.

Tighten Drawbar Knob on top of Drawbar to lock Adapter in place. DO NOT overtighten.



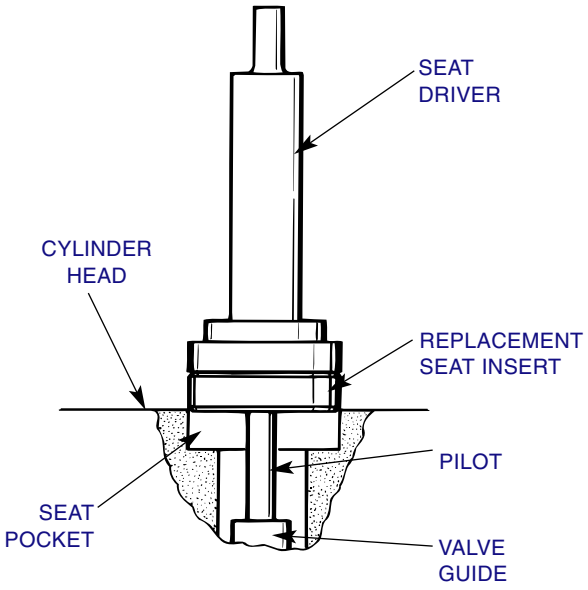


FIGURE 3-25, Install Seat Insert

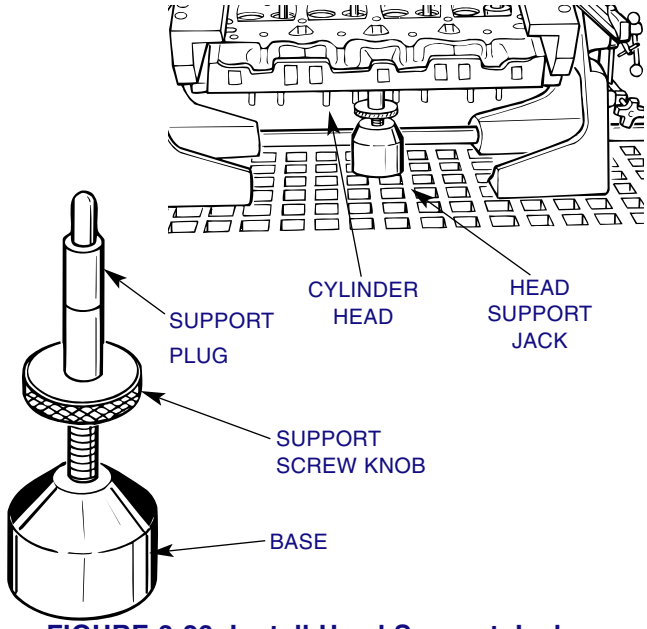


FIGURE 3-26, Install Head Support Jack

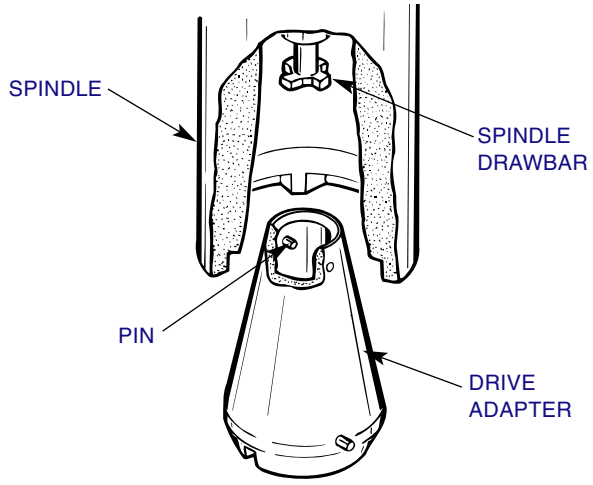


FIGURE 3-27, Install Drive Adapter

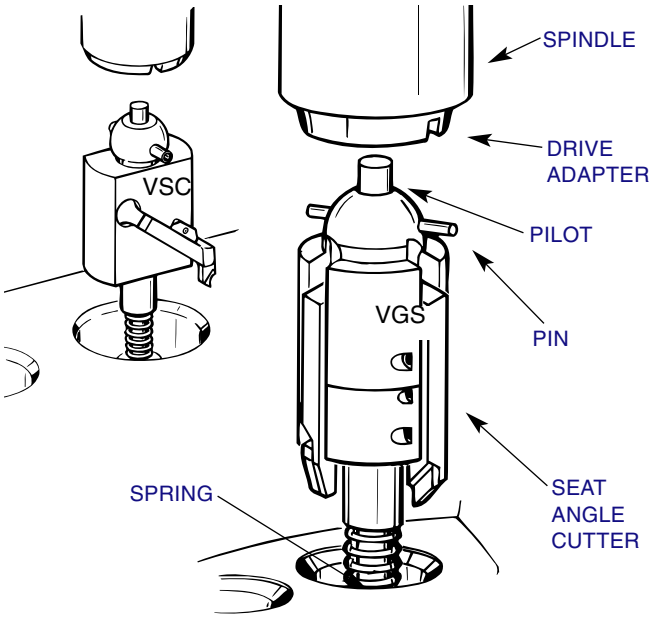


FIGURE 3-28, Install Seat Angle Cutter

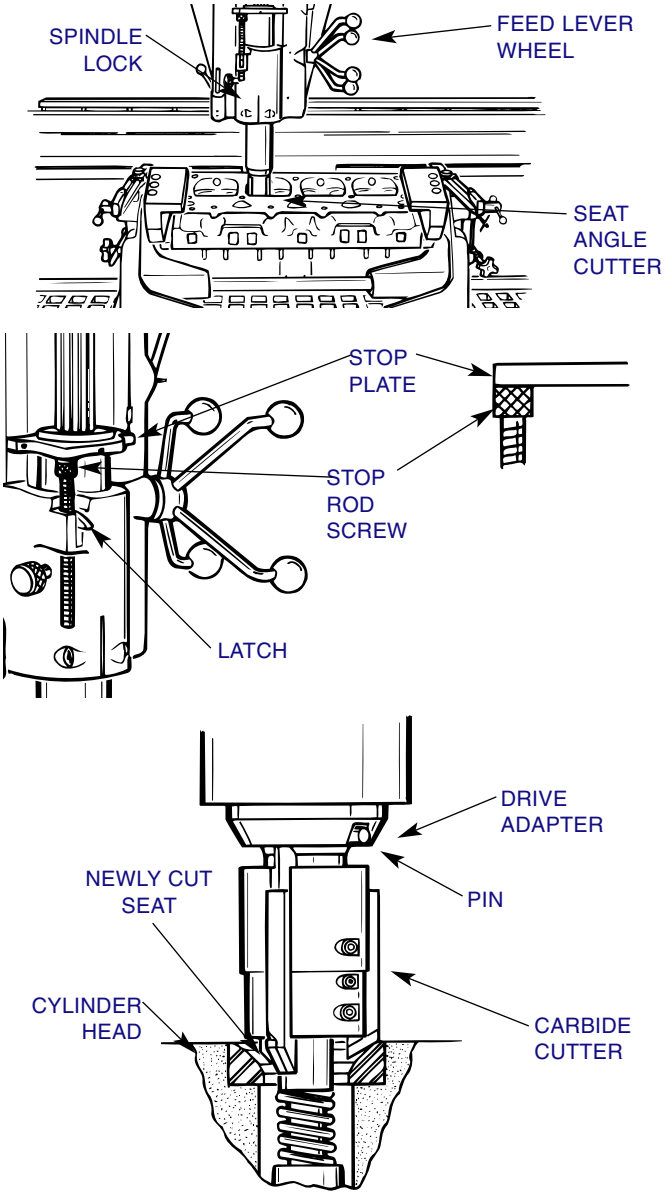


FIGURE 3-29, Align Seat Angle Cutter

7. Clean valve guides with brush to remove foreign matter.

8. To determine Pilot size, measure valve guides, using Sunnen P-300 Valve Guide Gage.

9. Install Pilots in valve guides of valve seats which are to be reconditioned. Install largest size Pilot that will fit into valve guide. Pilot should not be more than .001 in. (0,03 mm) smaller than valve guide.

10. Slide a return Spring on Pilot.

11. Select and set Seat Angle Cutter for diameter and angles of seat to be cut (refer to Section 2).

12. Slide Seat Angle Cutter on Pilot (see Figure 3-28).

13. Rotate Cutter to ensure Carbide Cutters will only touch valve seat and DOES NOT contact sides of combustion chamber.

14. Depress Foot Pedal and float Power Head so Drive Adapter is located over Cutter.

15. Use Feed Lever Wheel to run Spindle down until ball socket of Drive Adapter engages Pins on top of Cutter (see Figure 3-29).

16. With Cutter engaged, continue to run Spindle down until Cutter lightly touches valve seat. Back off slightly so Carbide Cutters are not in contact with valve seat; then tighten Spindle Lock.

17. Release your hands from Power Head to allow Head to stabilize and Cutter to center itself on Pilot.

18. Release Foot Pedal.

CAUTION

DO NOT depress Foot Pedal while cutting seat angle, as this will change Machine and Cylinder Head alignment.

19. Select Spindle Speed according to Table 3-5 and set Speed Control Dial.

TABLE 3-5, Suggested Cutting Speeds

DIAMETER in	DIAMETER mm	SPEED (RPM) VALVE SEAT
15/16	24	175
1	26	150
1-1/8	29	150
1-1/4	32	125
1-3/8	35	100
1-1/2	38	100
1-5/8	41	100
1-3/4	44,5	100
1-7/8	47,5	75
2	51	75
2-1/8	54	75
2-1/4	57	75
2-3/8	60	50
2-1/2	63,5	50
2-5/8	67	50
2-3/4	70	50
2-7/8	73	50
3	76	50

NOTE: Spindle Speeds shown in following table are offered as a suggested starting point. Actual operating speeds may vary according to material of valve seats to be cut.

20. Loosen Spindle Lock and retract Cutter slightly so Carbide Cutters are not contacting valve seat when Machine is started.

21. For Cylinder Heads with steel or stellite valve seat inserts; brush seat with an ample supply of Sunnen Cutting Oil to prevent overheating.

22. Depress START Button. Readjust Spindle Speed as required.

23. Cut Seat Angles: Run Cutter down at a steady feed rate until all three Angles have been cut to desired depth (see Figure 3-30).

24. Momentarily hold Cutter in full down position (for one or two revolutions), then back off Feed Lever Wheel and depress STOP Button.

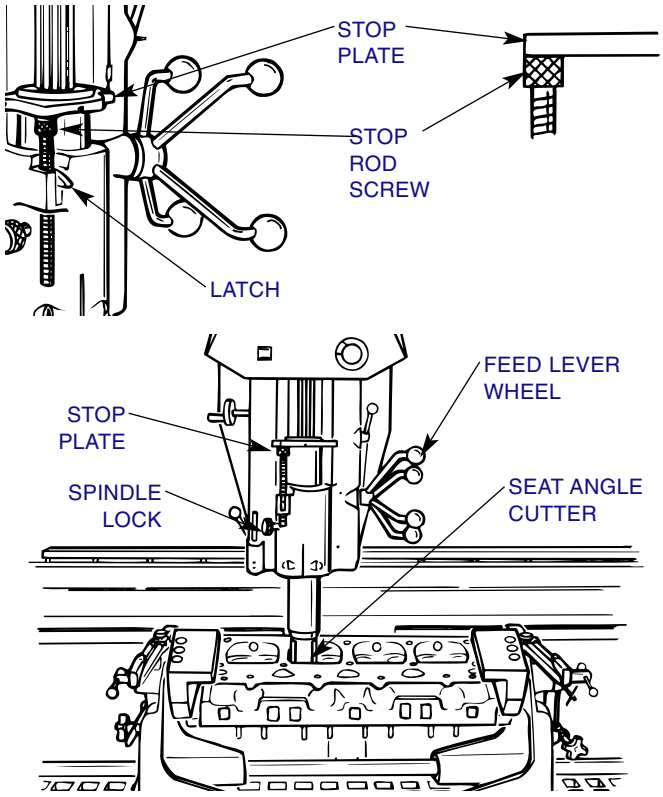


FIGURE 3-30, Cut Seat Angle

25. Again, run Cutter down until Carbide Cutters lightly touch cut Valve Seat Angles and tighten Spindle Lock.

26. Push Stop Rod Screw up against Spindle Stop Plate. This is to ensure all Valve Seats are cut to a consistent depth.

27. Remove Cutter and Spring from Pilot. DO NOT remove Pilot.

28. Check Valve Seat Angles using Sunnen Rapid Valve Seat Checker.

29. Cut seat angles on remaining valve seat (refer to steps 7–27).

30. Remove Pilots.

SECTION 4
ROUTINE MAINTENANCE

GENERAL

The following routine maintenance procedures and suggested service periods are provided as a guide and are not to be construed as absolute or invariable. Local conditions must always be considered. Each Machine must be maintained individually according to its particular requirements.

CLEANING

Daily: Wipe Rails with a clean, dry cloth. At all times, the Rails MUST be keep clear of foreign material, such as oil, to allow the Power Head to float freely.

Weekly: Clean Machine by wiping with a clean dry cloth, especially areas where metal chips may have accumulated.

Monthly: Clean exterior of Machine with warm water and a mild detergent or mild industrial solvent. Rinse thoroughly with clean hot water and wipe dry. Lightly lubricate following lubrication instructions.

LUBRICATION

Periodically lubricate the machine using the following procedures (see Figure 4-1):

SPINDLE WAYS: Wipe clean. Lightly lubricate Ways with graphite (or molybdenum disulfide). Wipe dry.

MACHINE RAILS: Wipe clean. Lightly lubricate Rails with WD-40. Wipe dry.

SPINDLE SHAFT: Wipe clean and dry. DO NOT oil.

IMPORTANT

Keep Spindle clean and dry. DO NOT oil.

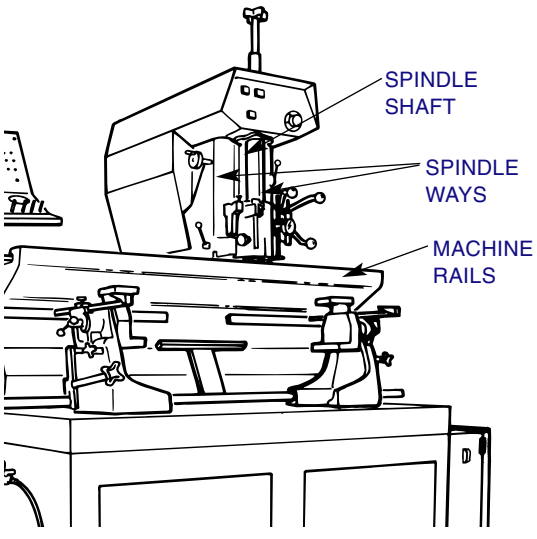


FIGURE 4-1, Lubrication Points

AIR LINE CHECK

Monthly: Inspect Air (Pneumatic) Lines and Fittings for leaks or damaged parts (see Figure 4-2). Replace as required.

Daily (8 hrs): Add a couple of drops (1,5 cc) of Dupont Moisture Gard to Air Lines.

Monthly: If your Air Hammer is equipped with grease plug, remove plug and add 2 cc of Mobilux Grease #EP023. Reinstall plug.

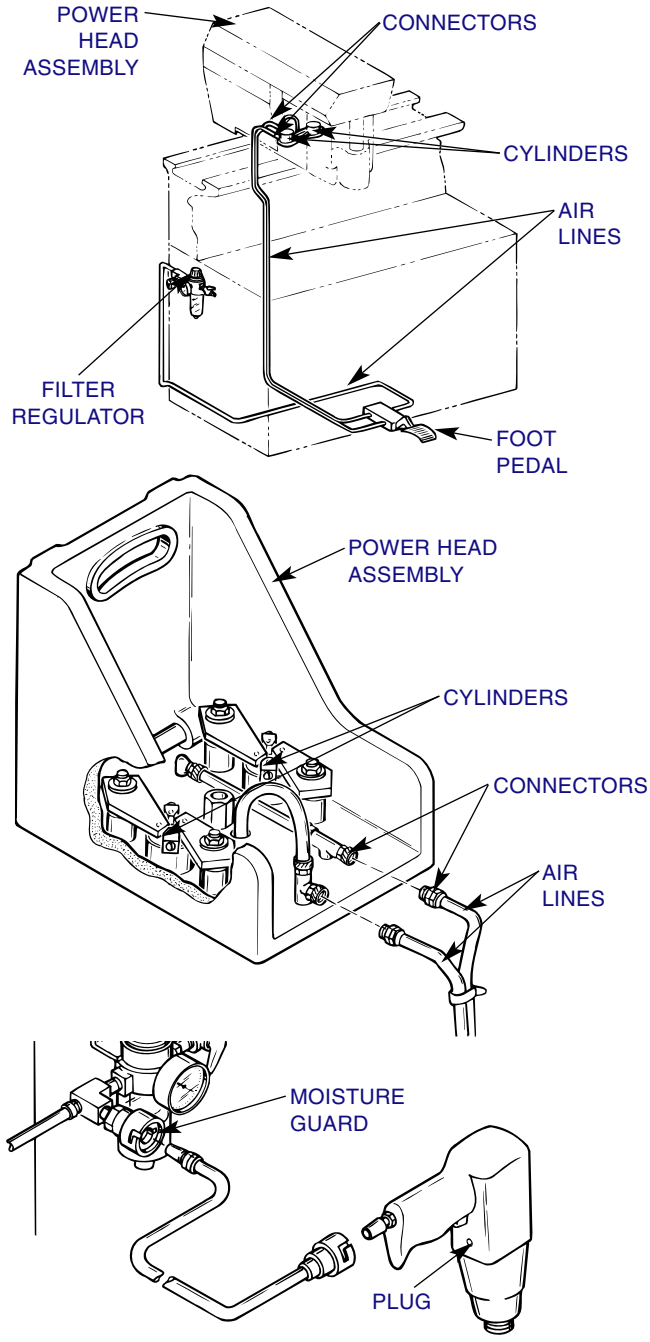


FIGURE 4-2, Air Line Check

FILTER ELEMENT

The Filter Element should be replaced when there is a noticeable drop in air pressure. To replace the Filter Element, proceed as follows (see Figure 4-3):

1. SHUT OFF air supply at Shut Off Valve.

2. Unscrew Threaded Bowl from Unit and lay aside.

CAUTION

Plunger is held in Unit by a Spring. Use care in disassembling to prevent Spring from being lost.

3. Unscrew Baffle, Remove Baffle, Filter Element, Cap, Spring and Plunger.

4. Wipe Bowl and internal parts clean.

5. Install new Filter Element on Baffle's Shaft. Then install Plunger, Spring and Cap in Unit; and while holding in position, screw Filter Element and Baffle Assembly into place.

NOTE: Replacement Elements and parts are available through the Unit's manufacturer or your local supplier.

6. Screw Bowl on Unit and firmly tighten.

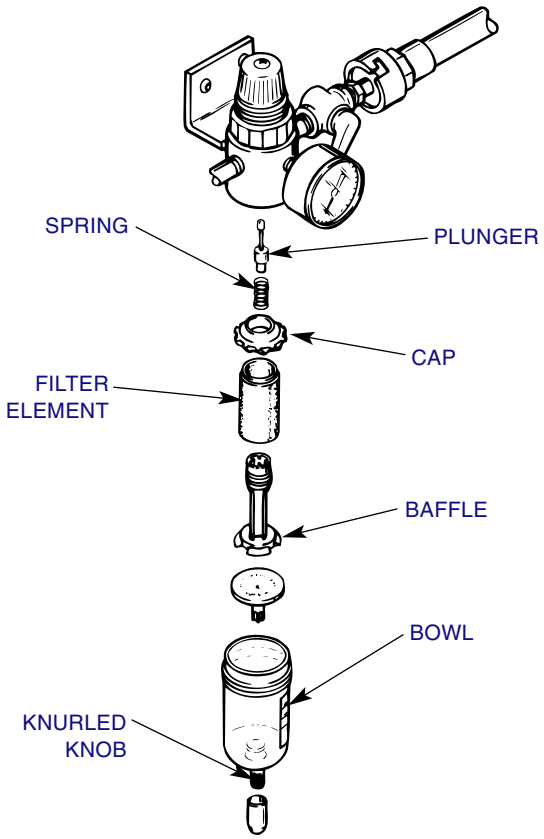


FIGURE 4-3, Filter Element

FILTER REGULATOR

Remove Cap and unscrew Knurled Knob on bottom of Bowl; drain accumulated moisture; and reinstall Knurled Knob.

ADJUSTABLE LEVEL

Adjustable Level should read the same when rotated 180º. If Level does not read the same, adjust Level as follows (see Figure 4-4):

1. Place Adjustable Level on the Leveling Pin located on the left-front of the Spindle Guide Housing.

2. Remove Adjusting Screw from Level and lay aside.

3. Rotate Level so it is parallel to Machine Table (left to right).

4. Note where Bubble is located between Markings on Level.

5. Rotate Level 180º. Bubble should be located in the same position between Markings on Level, only on the opposite end (refer to Figure 4-4).

6. Adjust Level by turning Socket Head Set Screw as required, using a 5/64 in. Hex Wrench.

7. Recheck adjustment by rotating Level 180º. Continue to adjust Level as required, until Bubble maintains the same location between Markings in both directions.

8. Remove Hex Wrench.

9. Reinstall Adjusting Screw removed in step 2.

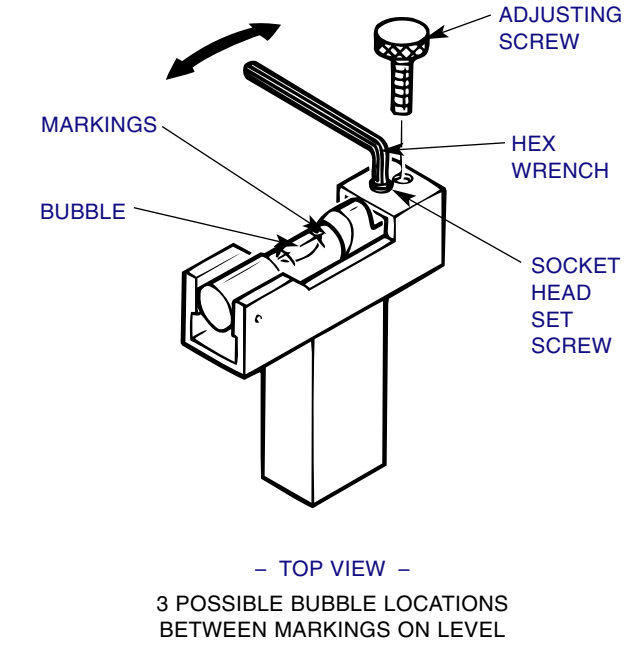


FIGURE 4-4, Adjustable Level

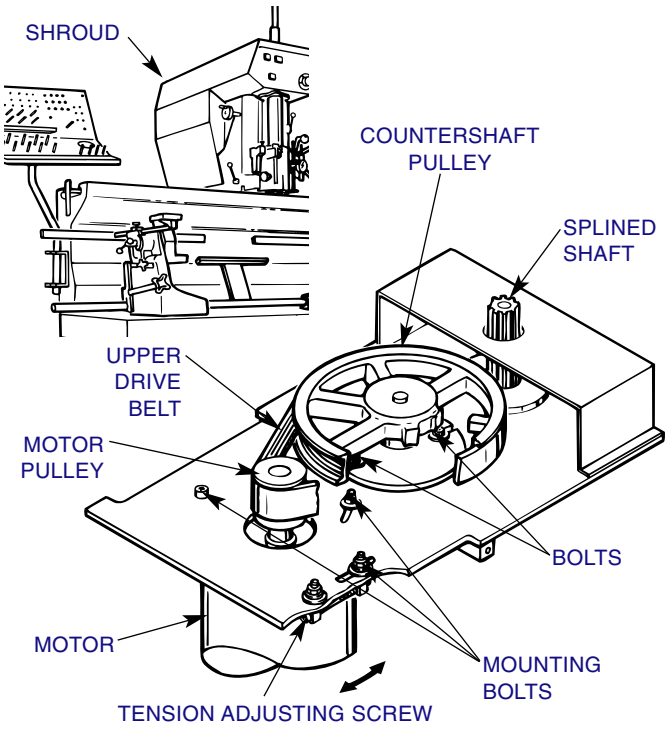


FIGURE 4-5, Adjust Belt Tension

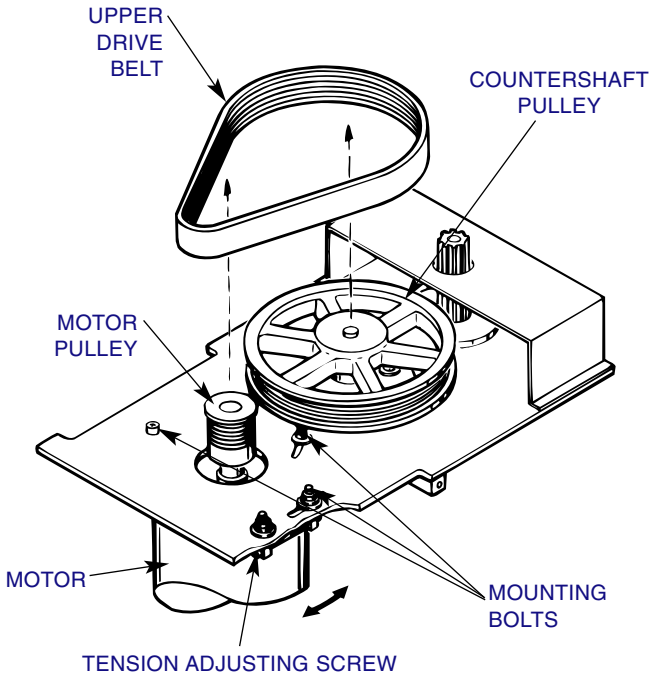


FIGURE 4-6, Replace Upper Drive Belt

BELT TENSION

To inspect Upper and Lower Drive Belts and to adjust Belt tension, proceed as follows:

1. Turn OFF power to the Machine.

2. With Spindle in full up position, unscrew Drawbar Knob and remove Drawbar from Spindle.

3. Run Spindle down so Spindle Shaft is below the Shroud. Lock Spindle by tightening Spindle Lock on left-front of Spindle Guide Housing.

4. Remove Back Cover from Shroud by removing two (2) Screws on each side of the Shroud. Lay Cover and Screws aside for reinstallation.

5. Remove six (6) Screws from each side of the Shroud. While slightly spreading the bottom of the Shroud, slide the Shroud forward and lift off of Power Head. Lay Shroud and Screws aside for reinstallation.

6. Inspect Belts for signs of wear or damage. Replace as required.

7. Check Upper and Lower Belt Tension. If Belts need adjusting, proceed as follows (see Figure 4-5):

Loosen three (3) Mounting Bolts and two (2) Bolts in Countershaft Assembly.

Turn Tension Adjusting Screw so Motor rotates rearward (toward the rear of the Machine). Snug three (3) Mounting Bolts; then tighten the two (2) Bolts in the Countershaft Assembly.

8. Replace Shroud and Back Cover.

9. Loosen Spindle Lock and run Spindle up until Spindle Shaft is above the top of the Shroud; then retighten the Spindle Lock.

10. Reinstall Drawbar in Spindle and reinstall Drawbar Knob.

11. Turn ON power to the Machine.

UPPER DRIVE BELT

To inspect and/or replace Upper Drive Belt, proceed as follows (see Figure 4-6):

1. Turn OFF power to the Machine.

2. With Spindle in full up position, unscrew Drawbar Knob and remove Drawbar from Spindle.

3. Run Spindle down so Spindle Shaft is below the Shroud. Lock Spindle by tightening Spindle Lock on left-front of Spindle Guide Housing.

4. Remove Back Cover from Shroud by removing two (2) Screws on each side of the Shroud. Lay Cover and Screws aside for reinstallation.

5. Remove six (6) Screws from each side of the Shroud. While slightly spreading the bottom of the Shroud, slide the Shroud forward and lift off of Power Head. Lay Shroud and Screws aside for reinstallation.

6. Inspect Lower Drive Belt for signs of wear or damage. Replace as required.

7. Inspect Upper Drive Belt for signs of wear or damage. If Belt needs replacement, proceed as follows:

Loosen three (3) Mounting Bolts and turn Tension Adjusting Screw so Motor rotates forward (toward front of the Machine) to release tension on Upper Drive Belt.

Loosen two (2) Bolts in Countershaft Assembly.

Remove old Upper Drive Belt from Pulleys.

Install and align new Upper Drive Belt on Pulleys.

Adjust tension of Upper and Lower Drive Belts by turning Tension Adjusting Screw so Motor rotates rearward (toward the rear of the Machine). Snug the three (3) Mounting Bolts; then tighten the two (2) Bolts in the Countershaft Assembly.

8. Replace Shroud and Back Cover.

9. Loosen Spindle Lock and run Spindle up until Spindle Shaft is above Shroud. Tighten Spindle Lock.

10. Reinstall Drawbar in Spindle, and reinstall Drawbar Knob.

11. Turn ON power to the Machine.

LOWER DRIVE BELT

To inspect and/or replace Lower Drive Belt, proceed as follows (see Figure 4-7):

1. Turn OFF power to the Machine.

2. With Spindle in full up position, unscrew Drawbar Knob and remove Drawbar from Spindle.

3. Run Spindle down so Spindle Shaft is below the Shroud. Lock Spindle by tightening Spindle Lock on left-front of Spindle Guide Housing.

4. Remove Back Cover from Shroud by removing two (2) Screws on each side of the Shroud. Lay Cover and Screws aside for reinstallation.

5. Remove six (6) Screws from each side of the Shroud. While slightly spreading the bottom of the Shroud, slide the Shroud forward and lift off of Power Head. Lay Shroud and Screws aside for reinstallation.

6. Inspect Upper Drive Belt for signs of wear or damage. Replace as required.

7. Inspect Lower Drive Belt for signs of wear or damage.

If Belt does not need to be replaced, proceed to step 34.

If Belt needs to be replaced, proceed as follows:

8. Loosen three (3) Mounting Bolts and turn Tension Adjusting Screw so Motor rotates forward (toward front of the Machine) to release tension on Upper Drive Belt .

9. Remove Upper Drive Belt from Pulleys.

10. Cut and remove old Lower Drive Belt.

11. Remove two (2) Bolts in Countershaft Assembly. Save for reinstallation.

12. Remove Countershaft Assembly. Save for reinstallation.

13. Remove Lower Idler Pulley by removing Screw from bottom of Pulley. Save for reinstallation.

14. Loosen Spindle Lock, and lower Spindle to expose Stop Plate. Tighten Spindle Lock.

15. Install a wooden Block under the Spindle.

CAUTION

Spindle MUST be supported by a Block while Counterbalance Cable is disconnected to prevent spindle from falling out of housing and causing damage to spindle or personal injury.

16. Pull Counterbalance Cable out, and hook on Roll Pin by right Eccentric Lock.

17. Mark Spindle Guide Housing and Sleeve on Feed Lever Wheel so Wheel can be reinstalled in the same position.

18. Loosen Set Screw in Spindle Guide Housing, and remove Feed Lever Wheel.

19. Remove Large Nut holding Stop Plate on Spindle.

20. Remove Set Screw in Slot under Stop Plate.

21. Mark Spindle Shaft and Pulley so Spindle can be reinstalled in the same position.

22. Remove Block from under spindle.

23. Loosen Spindle Lock and carefully lower the Spindle until it is out of Pulley. Continue to lower the Spindle, to allow enough room so new Belt can be slid between the Pulley and the Spindle Guide Housing. Tighten Spindle Lock and reinstall a Block under the Spindle.

CAUTION

Spindle MUST be supported by a Block while Counterbalance Cable is disconnected to prevent spindle from falling out of housing and causing damage to spindle or personal injury.

24. Twist new Lower Drive Belt so it lays flat, and slide Belt between Spindle Guide Housing and Pulley.

25. Reinstall Lower Idler Pulley using Screw removed in step 13.

26. Reinstall Countershaft Assembly using Bolts removed in step 11. DO NOT tighten Bolts at this time.

27. Install and align new Lower Drive Belt on Pulleys (Belt should ride in the same grooves in both Pulleys).

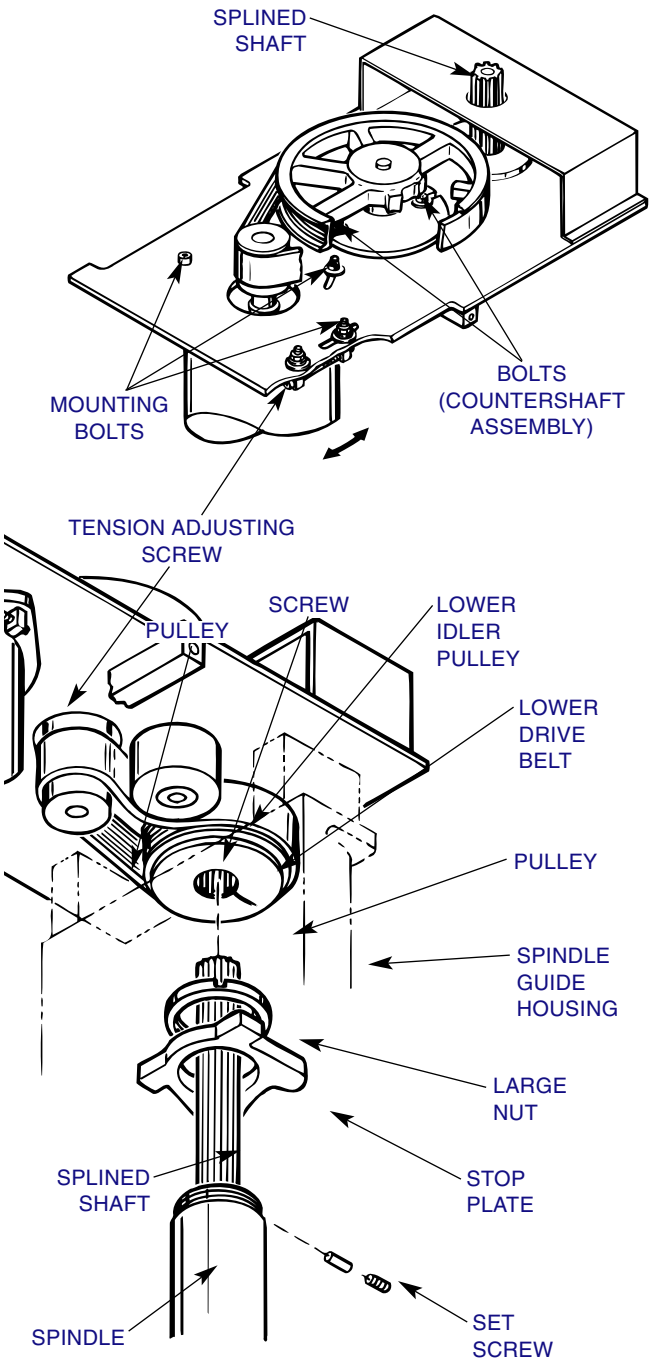
28. Loosen Spindle Lock. Align Mark on Spindle Shaft with Mark on Pulley, and raise Spindle so Stop Plate and Nut can be reinstalled. Tighten Spindle Lock.

29. Reposition Stop Plate. Reinstall and tighten Set Screw.

30. Replace and tighten Large Nut.

31. Remove Block from under Spindle.

32. Align Mark on Sleeve of Feed Lever Wheel with Mark on Spindle Guide Housing, and reinstall Feed Lever Wheel. Tighten Set Screw.



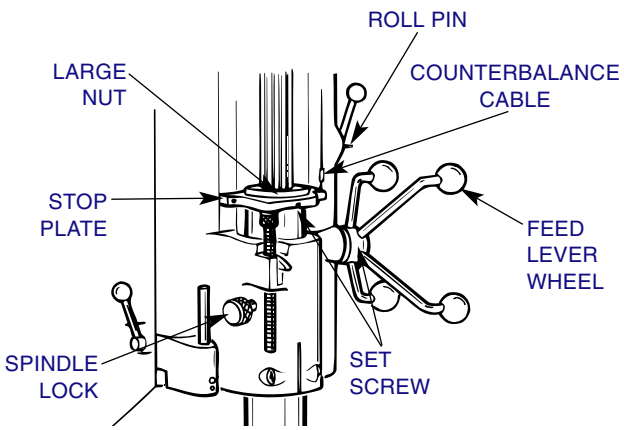


FIGURE 4-7, Replace Lower Drive Belt

33. Reattach Counterbalance Cable.

34. Install Upper Drive Belt.

35. Adjust tension of Upper and Lower Drive Belts by turning Tension Adjusting Screw so Motor Assembly rotates rearward. First tighten the three (3) Mounting Bolts in Motor Mount; then tighten the two (2) Bolts in the Countershaft Assembly.

36. Replace Shroud and Back Cover.

37. Loosen Spindle Lock, and run Spindle up until Spindle Shaft is above the top of the Shroud; then tighten the Spindle Lock.

38. Reinstall Drawbar in Spindle, and reinstall Drawbar Knob.

39. Turn ON power to the Machine.

Like any machinery, this equipment may be dangerous if used improperly. Be sure to read and follow the instructions for the operation of the equipment.

FRACTION / DECIMAL / MILLIMETER EQUIVALENTS CHART

INCH FRACTION	INCH DECIMAL	MILLIMETER	INCH FRACTION	INCH DECIMAL	MILLIMETER	INCH FRACTION	INCH DECIMAL	MILLIMETER
. . . .	.003937	0,1000	9/32	.281250	7,1438	21/32	.656250	16,6688
. . . .	.007874	0,2000	19/64	.296875	7,5406	. . . .	.669291	17,0000
. . . .	.011811	0,3000	5/16	.312500	7,9375	43/64	.671875	17,0656
1/64	.015625	0,3969	. . . .	.314961	8,0000	11/16	.687500	17,4625
. . . .	.015748	0,4000	21/64	.328125	8,3344	45/64	.703125	17,8594
. . . .	.019685	0,5000	11/32	.343750	8,7313	. . . .	.708661	18,0000
. . . .	.023622	0,6000	. . . .	.354331	9,0000	23/32	.718750	18,2563
. . . .	.027559	0,7000	23/64	.359375	9,1281	47/64	.734375	18,6531
1/32	.031250	0,7938	3/8	.375000	9,5250	. . . .	.748031	19,0000
. . . .	.031496	0,8000	25/64	.390625	9,9219	3/4	.750000	19,0500
. . . .	.035433	0,9000	. . . .	.393701	10,0000	49/64	.765625	19,4469
. . . .	.039370	1,0000	13/32	.406250	10,3188	25/32	.781250	19,8438
3/64	.046875	1,1906	27/64	.421875	10,7156	. . . .	.787402	20,0000
1/16	.062500	1,5875	. . . .	.433071	11,0000	51/64	.796875	20,2406
5/64	.078125	1,9844	7/16	.437500	11,1125	13/16	.812500	20,6375
. . . .	.078740	2,0000	29/64	.453125	11,5094	. . . .	.826772	21,0000
3/32	.093750	2,3813	15/32	.468750	11,9063	53/64	.828125	21,0344
7/64	.109375	2,7781	. . . .	.472441	12,0000	27/32	.843750	21,4313
. . . .	.118110	3,0000	31/64	.484375	12,3031	55/64	.859375	21,8281
1/8	.125000	3,1750	1/2	.500000	12,7000	. . . .	.866142	22,0000
9/64	.140625	3,5719	. . . .	.511811	13,0000	7/8	.875000	22,2250
5/32	.156250	3,9688	33/64	.515625	13,0969	57/64	.890625	22,6219
. . . .	.157480	4,0000	17/32	.531250	13,4938	. . . .	.905512	23,0000
11/64	.171875	4,3656	35/64	.546875	13,8906	29/32	.906250	23,0188
3/16	.187500	4,7625	. . . .	.551181	14,0000	59/64	.921875	23,4156
. . . .	.196850	5,0000	9/16	.562500	14,2875	15/16	.937500	23,8125
13/64	.203125	5,1594	37/64	.578125	14,6844	. . . .	.944882	24,0000
7/32	.218750	5,5563	. . . .	.590551	15,0000	61/64	.953125	24,2094
15/64	.234375	5,9531	19/32	.593750	15,0813	31/32	.968750	24,6063
. . . .	.236220	6,0000	39/64	.609375	15,4781	. . . .	.984252	25,0000
1/4	.250000	6,3500	5/8	.625000	15,8750	63/64	.984375	25,0031
17/64	.265625	6,7469	. . . .	.629921	16,0000	1	1.000000	25,4000
. . . .	.275591	7,0000	41/64	.640625	16,2719	1-1/16	1.062500	26,9880

FORMULAS:

MULTIPLY		BY		TO GET
INCHES (in)	x	25.4	=	MILLIMETERS (mm)
FEET (ft)	x	0.3048	=	METERS (m)

MULTIPLY		BY		TO GET
MILLIMETERS (mm)	x	0.03937	=	INCHES (in)
METERS (m)	x	3.281	=	FEET (ft)

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